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ABSTRACT

This issue of the bi-yearly publication contains 11 articles grouped under three headings: Developmental Cognitive/Perceptual Studies, Development of Assessment Tools Studies, and Effective Learning Studies. The research was carried out at the Lida Lee Tall Learning Resources Center on the campus of Towson (Md.) State University. This is a multi-dimensional, racially integrated educational research facility. Among many other activities, it houses an innovative early childhood and elementary education program for children aged six months to 12 years, and a model program for mainstreaming handicapped children. The studies are reported in brief, readable form, but the complete studies are available at the center for in-depth study by researchers. (Author/BP)

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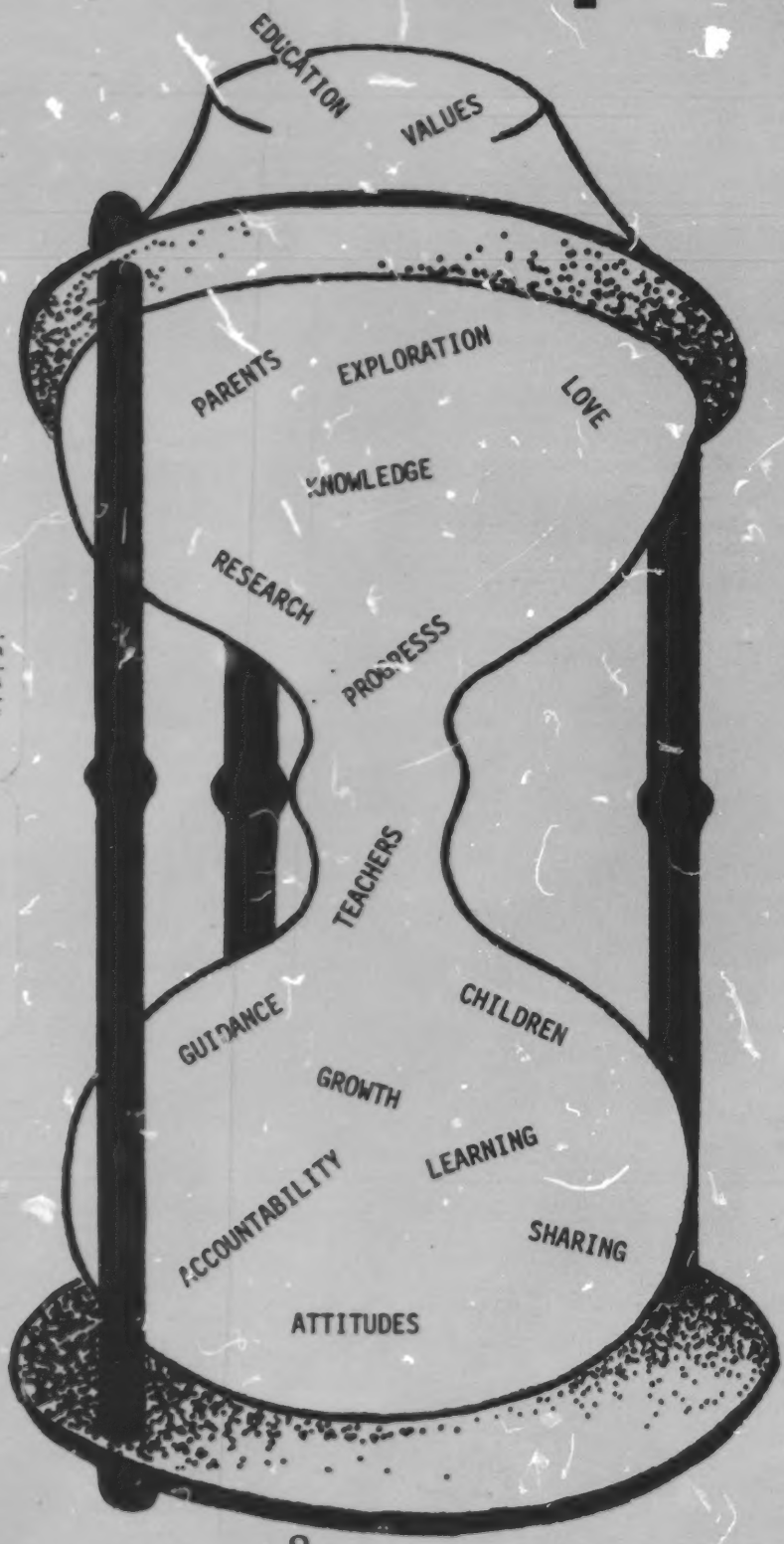

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LIDA LEE TALL LEARNING RESOURCES CENTER
TOWSON STATE UNIVERSITY
EDITORIAL COMMENT

The Lida Lee Tall Learning Resources Center on the campus of Towson State University is a multi-dimensional, racially integrated educational research facility serving a diverse set of functions. Ranging from an innovative early childhood and elementary education program for children six months of age to age twelve, (including two Day Care Centers) to a model program of "mainstreaming" handicapped children, (which has been in existence for several years), the Center exerts an increasingly powerful influence upon the shape of public education.

The faculty and staff at the Learning Resources Center are fully aware of the need to meetthe challenge of a society valuing diversity while concurrently placing a high priority on meeting the service demands required of a center devoted to educational inquiry. In an era of awakening self-awareness, our educational message is succinct: people of all ages must be equipped to meet the challenges of life on an individual basis rather than drift with the vagaries of society.

At Lida Lee Tall Center, there are many opportunities for educational research, observation, and demonstration functions. University students, faculty, educators, etc., can investigate the following representative samples:

1. A nursery school program for infants with parents having full organizational and administrative responsibility;
2. A nursery school program for four year old children, closely allied with the Early Childhood Department of Towson State University;
3. Two day care centers for children three to five years of age, working closely with the Early Childhood Department of Towson State University, and a variety of community agencies;
4. Seven additional classes of children ranging from kindergarten through section six, including special education;
5. An educational media teaching and learning center emphasizing the development and use of instructional media through independent inquiry;
6. Closed circuit programming focusing on instructional strategies, methods, and techniques;
7. A parent-participation program focusing on the development of parent-teacher partnerships with outstanding community interaction;
8. Special programs in art, music, physical education, drama, theatre arts, language and speech;
9. Innovative groupings of children;
10. Five week summer enrichment programs;
11. An observation-demonstration-participation center in every classroom;
12. A special program involving several community agencies focusing on the mainstreaming of children with emotional and behavioral problems in a regular classroom environment.

Since the learning process can be characterized as a life-long endeavor, and since educators are consistently looking for a catalytic agent in an effort to increase their effectiveness, the faculty of the Learning Resources Center has a serious obligation to share our activities for the overall good of our profession. The research function at the Lida Lee Tall Center has been an outstanding example of a commitment to societal change to refine or test theory in an

(Continued on inside of back cover)

probe

(Probing Resources of Better Education)

LIDA LEE TALL LEARNING RESOURCES CENTER
Towson State University Baltimore, Maryland 21204

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ON THE "SEMANTICS OF PERCEPTION"

Karen Heldmeyer and Stephen M. Kosslyn
The Johns Hopkins University

Young children obtain a great deal of information about their world from pictures. Almost from the time they start using language, the identification of pictures becomes an important and interesting task for them. Very little work has been done, however, on identifying the specific types of information that children can retrieve from pictures, or the processes by which this retrieval occurs. This is not that surprising in light of the fact that little is known about how adults identify pictures, either (although see Smith, Balzano, and Walker, 1976 or Hock, in press). As a first step toward trying to solve this problem, we propose to look at how both children and adults extract meaning from words for use in identifying pictures, and propose two competing models to describe what might be occurring in picture identification.

One of the most widely accepted theories of word meaning is the semantic feature theory (Clark, 1973; Smith, 1977). This theory states that all word meanings are combinations of many specific semantic features. Thus, something is a car if it has four wheels, has fenders, can be driven, etc. Such features are often perceptually based, and it is these perceptual features that are presumably the kind of information which is brought to bear in a picture identification task. There are two ways in which this might come about. The first is that, in identifying a picture, you have a list of perceptual features and you must check to see if all of those features are present before you can identify the picture. (This model does not depend upon all the features necessarily being present, just that each one must be checked.) The second possibility is that you select only a few features to check for, and if you find them to be present, you can then identify the picture.

These two models make differential predications for the subjects' reaction times when general (e.g., "animal") versus specific (e.g., "horse") labels are used to identify pictures. If you have to check for all features before identification can take place, then you should be faster when using general names than with specific, since the specific name contains all the features of the general label plus some features that are unique to itself. Thus, "horse" encompasses all the features of animal (like four legs or a tail) but also has features specific to horse (mane, horseshoes). If you have to look only for a few selected features, you should be faster with specific labels than with general, since the specific label carries unique information which is not as likely to be duplicated by other words. Thus, if something has a single horn on its head and a mane, it is highly probable that it is a unicorn. In order to test these two models, we designed two experiments where we varied label type (specific or general) and measured both children's and adults' reaction times when identifying pictures.

Method

Materials

Twenty drawings of common objects were made into colored slides for this experiment. This set consisted of two different specific examples from each of ten general categories (see Table 1 for a complete list). These category names and

and their exemplars were chosen because of their high frequency in children's literature, their pictorial nature, and their ability to be expressed in a single word (e. g., "musical instrument" was discarded as a category).

Procedure

Each subject was seen individually, the kindergarten children in a room at their school. Each subject was told that he would hear the names of two common objects, and immediately thereafter would see a picture of one of those objects. The subject's task was to say the correct name as quickly as possible without making any errors.

All subjects saw all twenty slides in the same randomized, fixed order. Each subject, however, started at a different, randomized spot on the list. The experimenter advanced the slide and told the subject both the correct name and the incorrect name. (The order of presentation of the correct and incorrect responses was counterbalanced both within and between subjects). At this signal, the subject looked at the center of a rear-projected screen, which was marked with a white dot. The experimenter opened the shutter, thus exposing the picture and starting the reaction time clock. When the subject responded by saying a word into the microphone, the clock was stopped and the slide was terminated.

Each subject received four practice trials before he saw the actual stimuli. During the practice trials, the instructions were clarified for the subject if necessary.

Although all the subjects saw the same slides, each subject had different names associated with those slides. For a given subject, a correct response to a picture was either its general category name (e. g., "fruit") or its specific name (e. g., "apple"). Additionally, the correct response could be paired with an incorrect response that either closely resembled or did not resemble at all the pictured object. For example, for "apple" the object that resembled it (the near distractor) was "ball", the dissimilar object (the far distractor), "church". The particular distractors used with a picture were chosen through the ratings of 20 adults, who judged the physical similarity of the stimulus objects and the distractors.

Each subject, then, received five trials from each of the four possible combinations of labels and distractors: general name-near distractor, general name-far distractor, specific name-near distractor, and specific name-far distractor. The type of trial was counterbalanced for the ten general categories and their distractors within each age group. Within a given category for a given subject, however, the two exemplars of the same category served as reciprocals of each other for both correct response and type of distractor. Thus, if "apple" was a general-near trial, "grapes" was specific-far. This was to guarantee that every subject heard every category name and every distractor only once.

Only correct responses were included in the analysis. Wild scores were also discarded, with a wild score being defined as more than twice the mean of the other scores in the same stimulus group (generality of correct response x type of distractor). Any discarded scores were replaced with the mean for their particular block of stimuli. If more than two scores per block had to be discarded for a given subject because of errors, that subject was replaced.

Subjects

Seven girls and thirteen boys from the Lida Lee Hall Learning Resources Center served as the kindergarten subjects for this experiment (mean age = 5 years, 10 months). Twenty college students (13 males and 7 females), whose mean age was 21 years, 2 months, were paid for their participation in this study. The data from two additional kindergarten subjects were discarded, one because of equipment failure and one because she made more than the maximum allowable number of errors.

Results

Reaction Times

The major finding of this study was that, on the average for both adults and children, it took 163 msec less time to name a picture when it was labeled with a specific word than with a general one, $F(1,38) = 55.08$, $p < .001$. The distractors were successful in that it took 95 msec longer to respond when the correct label was paired with a near distractor than with a far one, $F(1,38) = 31.55$, $p < .001$.

Not surprisingly, the children took a great deal more time (534 msec) to respond than did the adults, $F(1,38) = 74,42$, $p < .001$. Additionally, the effects of both generality and distractor level were more pronounced with the children than with the adults (Age x Generality $F(1,38) = 17.27$, $p < .001$; Age x Distractor $F(1,38) = 4.41$, $p < .05$). These interactions (which are illustrated in Figures 1 and 2) may be due to floor effects in the adults' reaction time data.

Errors

Only one error was committed by any of the adults, and it was in the specific name-near distractor category. The children had a 4% error rate. The general label - near distractor category accounted for 2.8%, with the general name - far distractor block having another .8% The only errors which were made to specific names were with near distractors, and this accounted for another .5% error. Half of all the children's errors occurred when they gave a response which was neither of the two given alternatives.

Discussion

Both children and adults could more readily identify pictures with specific labels than general ones. These data lend support to our second model which stated that only selected features need to be detected when identifying a picture. It might be the case, however, that these results were more a function of the specific experimental paradigm we used, rather than of the general processes which underlie all picture perception.

Perhaps colored drawings give so much detail that it is easiest for the subject to respond on the basis of a single attribute (e.g., "if it's purple, it's got to be grapes"). If this is the case, the effect would be heightened by the procedure used in Experiment 1, in which the alternatives are presented before the picture comes on. The approximately two seconds between the onset of the names and the onset of the picture may be enough time to utilize a strategy of selecting and then searching for one given attribute, rather than a constellation of

attributes.

The naming response may have another effect on the results we obtained. Although we tried to find categories and exemplars which occurred equally often in written language, this may not accurately reflect their usage in speech. Perhaps, the "specific" words are spoken more often, and are thus more available as an oral response. It was in order to clarify these points that Experiment 2 was devised.

Experiment 2

Method

Materials

The 20 color slides from Experiment 1 were made into black and white line drawings, and these were used for the "true" trials. An additional 20 line drawings of common objects were made to be used for the "false" trials. These drawings and the labels with which they were used are listed in Table 2.

Procedure

As before, subjects were seen individually. They were told that they would, at the same time, see a picture of an object and hear a name for that object. If the object and the name were the same, they would push one button (marked with a smiling face). If they were different, they would push another button (a frowning face). Whether the subject pressed the "true" button with his dominant or non-dominant hand was counterbalanced over subjects within each age group.

When the experimenter advanced the slide, the subject looked at the fixation point on the screen. The experimenter then read the label for that trial (which could either match or differ from the picture) into a voice key, which both exposed the slide and started the reaction time clock. When a subject pressed either button, he stopped the clock and terminated presentation of the slide.

The slides were divided into two groups of 20, one containing the 10 false trials in which the pictured object strongly resembled the named alternative (the "near distractors"), and one containing 10 incorrect pictures which did not resemble the name that was supplied by the experimenter (the "far distractors"). Each list also contained 10 true trials, one from each general category. The presence of a specific true trial in either the near or far distractor list was counterbalanced within each age group, as was the order of presentation of the two lists. Each block of trials was preceded by four practice trials of the same type (using either near or far distractors).

A given list (whether a particular slide was labeled with a general or specific word) was counterbalanced within each age group, with the restriction that for a given subject one general and one specific word was used from each of the 10 categories. Each subject received five of each type of trial: true - general-near distractor; true - general name - far distractor; true - specific name - near distractor; true - specific name - far distractor; false - general name - near distractor; false - general name - far distractor; false - specific name - near distractor; false - specific name - far distractor. As with the first experiment, each list had been randomized into one fixed order, and each individual

began at a different spot on the list.

Scores were tabulated as in Experiment 1, with each block of trials consisting of each unique combination of truth, generality and distractor.

Subjects

A total of 16 kindergarten subjects from the Lida Lee Tall Learning Resources Center served as subjects. There were eight males and eight females, with a mean age of 5 years, 7 months. Twelve male and 4 female college students (mean age 19 years, 2 months) took part in this study and were paid for their participation.

The data from 6 additional kindergarten subjects was discarded. The equipment failed with one subject, and the remaining 5 subjects committed more than the maximum allowable number of errors.

Results

Reaction Times

Once again, as in the previous experiment, response to general words was considerably slower (by an average of 63 msec) than was response to specific labels ($F(1,28) = 5.18$, $p < .025$). Subjects responded to true trials 123 msec faster than they did to false trials ($F(1,28) = 17.74$, $p < .001$). The effect of the distractors, that is, whether a trial was in a block with falses having either near or far distractors, was not significant ($p > .05$).

The significant two-way interaction of generality and truth ($F(1,28) = 7.69$, $p < .01$), illustrated in Figure 3, would seem to indicate that specific or general words affect reaction times only on true trials, with false trials remaining virtually unaffected. The interaction of generality x truth x distractor ($F(1,28) = 5.66$, $p < .025$), which is illustrated in Figure 4, paints a slightly more complicated picture. The true responses are faster with a specific label than a general one, regardless of distractor. Type of distractor does seem to affect false responses, however. With the near distractor, the falses resemble the trues: responses to specific stimuli are faster than those to general ones. With far distractors, however, false responses are faster with general labels than with specific tags.

Age was again a significant factor, with the adults responding 1183 msec faster than the children ($F(1,28) = 138.42$, $p < .001$). The difference in response times between the true and false trials was relatively greater for the children than for the adults ($F(1,28) = 9.00$, $p < .01$), and this is illustrated in Figure 5.

Errors

The children had an error rate of 7.3% compared to the adults who averaged 5.8% errors. Both children and adults made more errors with general labels than specific ones, and more errors with near distractors than with far. The children made more errors on true trials than on false (4.8% true vs. 2.5% false), a trend that was reversed in the adults (2.8% true vs. 3.0% false).

Discussion

Even with the modifications we introduced, the results of the second experiment mirrored those of the first. Thus, we have seen from two different experiments that both children and adults are faster when having to identify pictures with specific labels than general ones. This lends support to the idea that people choose specific features to search for when identifying pictures. It also shows that children are able to extract information from one context (words and their meanings) and apply it to a different context (the perceptual task of picture identification) in a way that strongly resembles that of adults. The next question to ask is how particular features come to be selected for the search task, and whether the different types of features that are selected change over age.

Table 1
Correct Items
Experiments 1 and 2

General	Specific
animal	horse
	cow
toy	top
	block
fruit	apple
	grapes
vegetable	carrot
	corn
drink	milk
	soda
building	barn
	house
tool	hammer
	saw
bug	spider
	bee
clothing	hat
	mitten
flower	rose
	daisy

Table 2
False Items
Experiment 2 Only

General Label	Specific Label	Near Distractor	Far Distractor
pet	puppy	monkey	spoon
bird	robin	butterfly	bell
dessert	cake	sandwich	bus
person	boy	snowman	sun
furniture	chair	crate	wheel
game	checkers	map	pan
tree	oak	telephone pole	clock
boat	canoe	cradle	star
money	penny	button	window
candy	lollipop	stop sign	basket

References

Clark, E. V. What's in a word. In T. E. Moore (editor), Cognitive development and the acquisition of language. New York, Academic Press, 1973, 65-110.

Hock, H. S., Gordon, G. P., and Corcoran, S. K. Alternative processes in the identification of familiar pictures. Memory and Cognition, in press.

Smith, E. E. Theories of semantic memory. In W. K. Estes, (editor), Handbook of learning and cognitive processes (volume 5). Hillside N. J. Lawrence Erlbaum Associates, 1977.

Smith, E. E., Balzano, G. J., and Walker, J. Nominal and semantic processes in picture categorization. Paper presented at the UCSB Conference on Semantic Factors in Cognition, 1976.

Figure 1
Interaction of Age and Label Type
Experiment 1

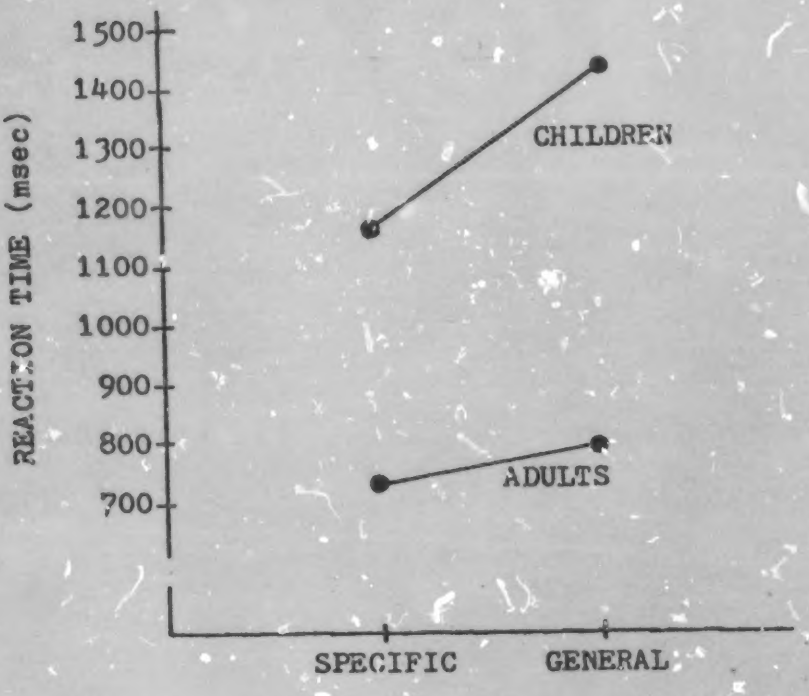


Figure 2
Interaction of Age and Distractor
Experiment 1

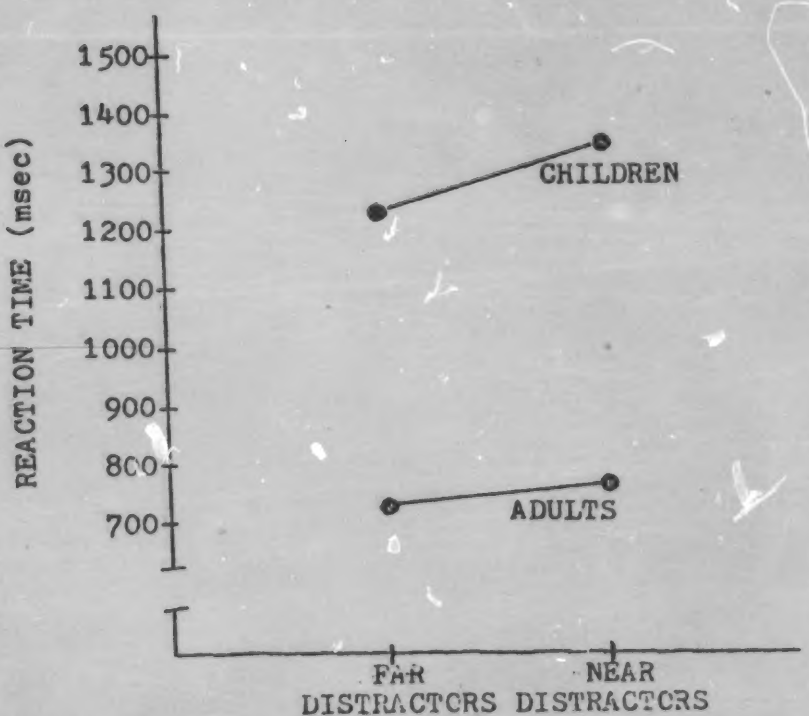


Figure 3
Interaction of Age and Label Type
Experiment 2

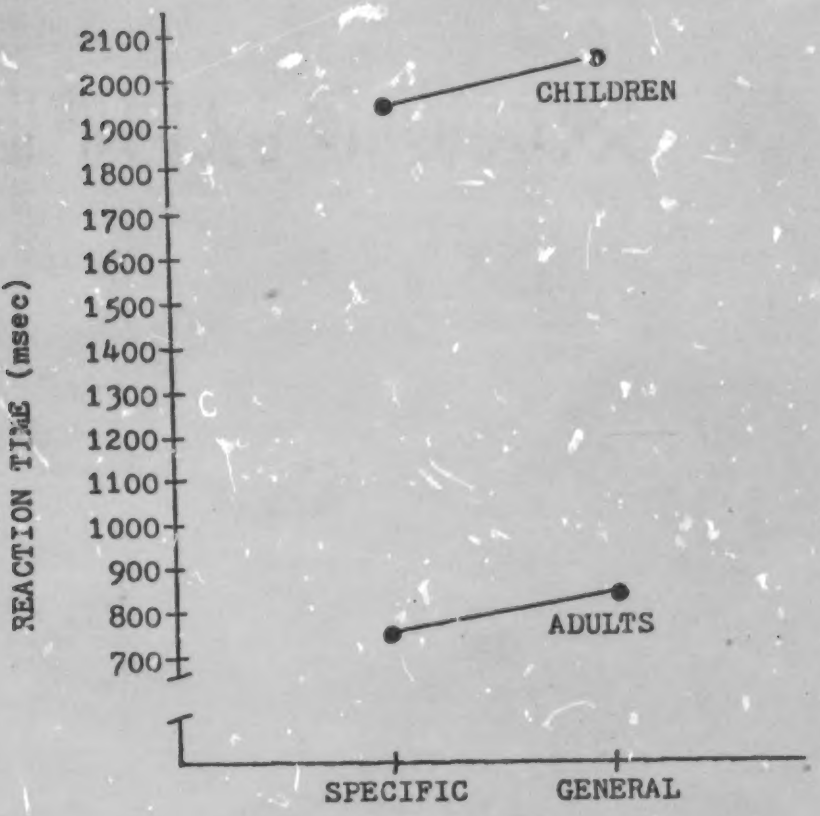


Figure 4
Interaction of Truth Value and Label Type
Experiment 2

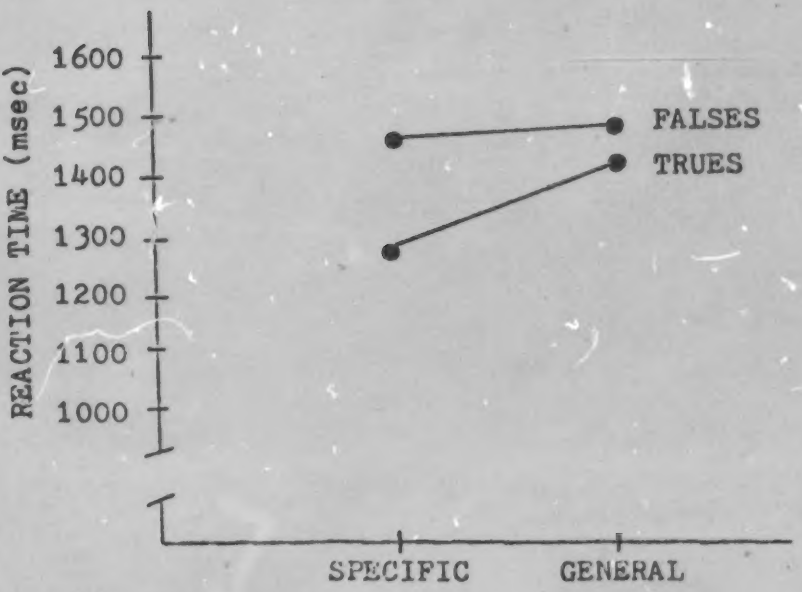
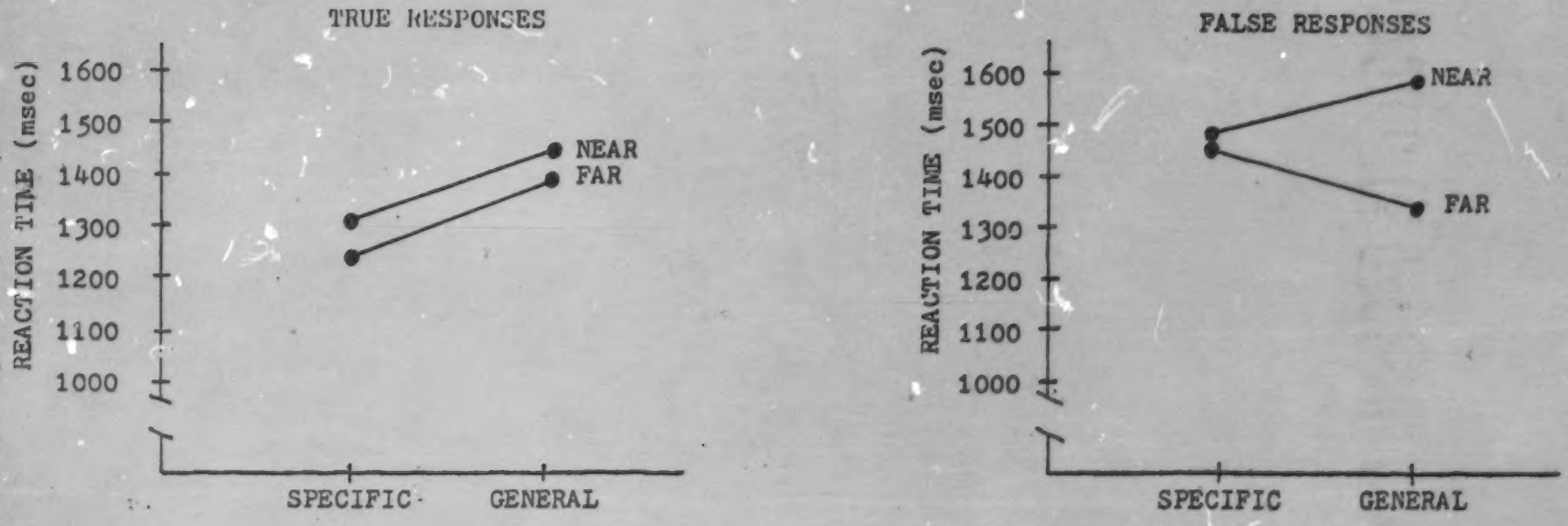


Figure 5

Interaction of Distractor, Truth Value, and Type of Label

Experiment 2



CHILDREN'S DRAWINGS AS DATA ABOUT THE NATURE OF INTERNAL REPRESENTATIONS: A Study of Picture Perception and Artistic Development

Stephen M. Kosslyn, Karen H. Heldmeyer, Eileen P. Locklear
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Abstract

This experiment was designed to explore the claim that the form of children's drawings reflects the nature of their representation of pictured objects in memory. In the first part of the experiment, children of four different ages viewed simple objects one at a time and indicated what sort of drawings (some incorporating conventional perspective and some not) they thought best depicted the object's appearance. On behalf of these trials, the object was physically present during picture selection, and on half it was not. In the second part of the experiment, children simply drew each object in turn. The finding of greatest interest concerned "diagrammatic" pictures (which show the parts of an object and their interrelationships without regard to perturbations of the proximal stimulus due to depth, partial occlusions, etc.) Although very few children preferred these types of drawings, many actually drew them. The results taken as a whole cautioned against making inferences about internal representations from children's drawings.

Children's drawings often have been regarded as a source of evidence for claims about the development of perception and internal representation (e. g., Piaget and Inhelder, 1956). One claim currently in favor among researchers developing computer models of cognition (e. g., Minsky and Papert, 1972; Moran, 1974) is that children's drawings reveal the schematic, "symbolic" nature of their mental representation. Drawings of cubes, for instance, are reported anecdotally to resemble unfolded cubes, usually being depicted as a central square with a square attached to each side. Minsky and Papert queried their subject about his drawing and concluded that it represented the front face and the attached sides of the object. This led them to infer that the child's internal representation was not perceptual in the same way that a visual image is, but rather was more akin to an abstract description that represents the parts and the relationships between the parts in a straightforward manner, without regard to perturbation in the proximal stimulus (e. g., foreshortening).

The notion that children's memories of the physical world are characterized by abstract descriptions is at odds with the contention, popular among some developmental psychologists (e. g., Bruner, Olver, and Greenfield, 1966; Church, 1961; Kosslyn and Bower, 1974), that young children rely on mental imagery as the predominant mode of internal representation of information. Images, unlike descriptions, necessarily preserve percept-like properties, and will implicitly represent information about occlusions, perspective, etc. In the face of these conflicting views on the nature of children's internal representations, it is not clear how much weight we ought to assign to the currently available data about children's drawings. We worry about making inferences on these grounds for three reasons: First, few children have been studied with this problem in mind, even fewer examined systematically. Second, the data are often in the forms of anecdotes and observations made in uncontrolled situations. Third, drawing includes

an output stage which is separate and distinct from both perception and internal representation. That is, the child's drawings are affected by his motor skills, conception of pictorial conventions, ability to coordinate separate parts as he draws them, and so forth; distortions in a drawing may be a consequence of any of those factors.

The present experiment is an attempt to discover whether children's perceptions and drawings of objects do provide any evidence suggesting that the children are relying on abstract descriptions of structure. No previous study of children's drawings (e. g., Lewis, 1963) has been conducted with an eye towards critically examining this claim. Although these internal representations are hypothesized to be abstract, they may be described and depicted by specifying which of an object's parts are included and how these parts are situated in relation to one another. Obviously, delineating an object's "parts" is problematical; in the absence of a comprehensive theory of perceptual parsing, for present purposes we simply selected stimuli for which we had clear intuitions as to what the component parts were. For example, following Minsky and Papert, our description of a cube's appearance was "a square front face with a square face attached to each side". In the case of a drawing, a picture executed to match such a representation ought to be "diagrammatic", that is, it should depict the basic parts and their relationships clearly, without regard to effects of foreshortening, partial occlusions and the like. If children draw diagrammatic pictures of objects (as has often been claimed, e. g., Arnheim, 1974) because they provide the best means of externalizing their internal representations, then they also should prefer diagrammatic pictures (like the unfolded cube) over depictions that utilize the conventions of Western perspective; a diagrammatic illustration would preserve only those aspects of the appearance the child encoded, whereas, a perspective picture obscures parts and includes additional information not included in the child's internal representation.

If children do prefer a diagrammatic representation over the standard perspective drawing of an object, it may be for reasons other than the one put forth by the computer theorists. Such a picture might be preferred because it has fewer different types of parts, or because it is more symmetrical than the perspective version. Alternatively, perhaps the folded version of a cube, for instance, is preferred because it has more squares, and the relationship between them is unimportant. In order to explore these sorts of possibilities, we employed a running sequence of two-alternative forced-choice trials, wherein a child had to select which of a pair of drawings was a "better picture of," or "looked more like," an object. As soon as the child chose a picture, it was immediately paired with another picture which differed from the first in respect to some property (e. g., whether or not the squares were connected). By asking the child to make repeated preference judgments, and by presenting new alternatives which differed along a selected dimension, we hoped to begin to isolate the variable(s) which were affecting the child's choice.

Similarly, if children draw in a diagrammatic manner, it might be for different reasons than those offered above. Perhaps such drawings require less processing capacity to produce. Each local part may be drawn independently, without regard for its relation to other parts of the same object. Furthermore, while some diagrammatic drawings do not make use of oblique lines, most perspective drawings do; it is well known that young children have trouble drawing diagonals (Olson, 1972). The use of a diagrammatic representation seems particularly efficient (in terms of processing capacity) when the drawing is iterative, i. e., when the same part is simply repeated around a central base. Thus, half of our objects were selected to be easily depicted by iterative diagrams and half were chosen because they could not be so depicted. The generality and force of the "abstract

description" claim would be diminshed if children drew only iterative objects in a diagrammatic manner.

Finally, half of the objects were physically present when the child made his preference judgments, and half were not. When the object is not present, the child is forced to rely on memory representations. This condition was included for two reasons: First, it prevents any special strategies that circumvent reliance on internal representations (like point-for-point matching, a form of which may be possible when the object is physically present). Second, this variation allows us to assess whether the children have the same sort of information available in memory as is utilized in making the judgments when the objects are physically present.

Method

This experiment has two parts: First, children viewed objects and selected which drawings were preferred depictions of the objects. Half of the objects remained visible during picture selection, whereas the other half were not physically present when the child indicated his preferences. Second, after judging all the pictures, the children drew each object in turn as it was placed in front of them.

Materials

The objects: We constructed two types of three-dimensional stimulus objects of beige cardboard. The "Iterative" objects had four identical sides, while the four sides of the "Non-iterative" objects were not all the same shape. The two iterative objects were: 1) a cube, 4" high, and 2) a "sticks" figure, which consisted of a 7" square base with two vertical 5" high dowels spaced equally along each side. The non-iterative objects were 1) a prism 3.5"high, 5.5" wide, and 7.5" long and 2) a "house" shaped object, 4.75" high, 5" wide, and 6.5" long. These stimuli were chosen because of their frequent occurrence in anecdotes about and observations of children's drawings (e. g., Arnheim, 1974; Lewis, 1963: Piaget and Inhelder, 1956). These four objects are pictured in the top line of Figure 1.

See Figure 1

The drawings: We also prepared six different drawings of each objects. These drawings were done with black ink on white cardboard; the pictures were 5" square and guarded by transparent plastic coverings. Each drawing represented the object in a particular way:

1. conventional perspective--the standard way of depicting perspective in our culture, with the front face shown perpendicular to the line of sight and the side represented at an angle of approximately 45° to the front.

2. diagrammatic--this depicts different sides in the same plane at the same time.

3. symmetrical perspective--the front face is shown perpendicular to the line of sight, and the top recedes toward the vanishing point.

4. complex perspective--the same as conventional perspective, but with an extra angle in the side of the drawing. Our intuitions were that this angle made the figure more complex.

5. front face--the outline of the front face of an object, shown without top or sides.

6. multiple--four small front outline pictures presented adjacently but unconnected on one card.

The portion of the card covered by each type of drawing was approximately the same. The drawings used for each object are illustrated in Figure 1.

Procedure

The children were seen individually in a room at their school, and were told that they would see several different objects and some pictures of these objects. On the first trial, the child was shown one of the four stimulus objects; the model was always placed on a table in front of the subject at an angle that was halfway between that of the conventional perspective and symmetrical perspective drawings. The experimenter did not name the object; if the child asked what it was, he was told that it was something the experimenter had made from cardboard and tape. For half the subjects, the model remained in sight during the subsequent display of the drawings (perception presentation); the other subjects were instructed to try to remember what the object looked like, and then it was removed (memory presentation). Which object was presented first and whether the first trial was a perception or memory presentation were both counterbalanced within each age group.

After the stimulus object had been presented (and then removed, in the case of a memory presentation), the subject was shown the conventional perspective and diagrammatic drawings of that object placed side by side (Trial 1 in Figure 1); the position of each picture was counterbalanced both within age groups and also over trials for each subject. The experimenter asked, "Which is the best picture of what we saw?" Obviously, what is "best" depends on one's purpose; we left this question ambiguous because in part we are interested in the child's rationale for his selection. After the subject had chosen one of the drawings, he was asked to give a reason for his answer. If his choice was not based on the perceptual characteristics of the drawing, or if the reason given for his choice was unclear, we then asked, "Which picture looks more like what we saw?" This second question served to focus the child's attention on the representational aspects of the drawing. Again, we asked the child to provide us with a rationale for his choice. This procedure was designed to minimize the number of answers which were based on idiosyncratic associations and not on the child's internal representations of the object (e. g., the diagrammatic cube is the "best picture" not because it resembles the cube, but because it is a "holy cross").

After the child had made his choice, and given us a reason for it, both pictures were removed. The symmetrical perspective picture (Trial 2 in Figure 1) was then presented along with the drawing the subject had just chosen, and the same questions were repeated. If the subject had been asked both forms of the question and had given conflicting replies, his answer to the second question determined which drawing was retained for comparison with the drawing presented subsequently. The complex perspective drawing, the front face drawing, and the multiple drawing were then successively presented to the subject (as is schematized in Figure 1). In each case, the novel picture was paired with the immediately preceding choice, and questioning proceeded as before.

The second object shown to the subject was always from the same stimulus pair (iterative or non-iterative) as the first, but the type of presentation (memory or perception) was the opposite of that used for the first object. After the questioning about this object was completed, the members of the other stimulus pair were presented consecutively, one as a perception trial and one as a memory trial. As with the first pair, which object was presented first and the type of presentation were completely counterbalanced within each age group. For all stimulus objects, the questioning procedure remained the same.

Finally, after all questioning had been completed, the subjects were again shown the stimulus objects, one at a time and in their original order, and were asked to draw a picture of each one while the object was still in view. If a child was dissatisfied with his drawing, he could correct it or draw another if he wished; in fact, many children did so spontaneously. In those cases, only the final drawing was included in the analysis.

Drawings were obtained only after preference selection for two reason. First, we were concerned that if drawing preceded selection, children would tend to pick the picture most like their own drawing, even if it was not actually perceived as the best likeness. Second, by letting the children indicate preferences first, we had a better notion as to what sort of internal representation the child is trying to externalize by his drawing. A failure to draw in the preferred fashion is even more telling if the child remembers what his earlier preference was, but for some reason cannot depict it; such data would caution against making strong inferences about internal representations from drawings.

Subjects

The sixty-four children (16 each from nursery school and grades 1, 3, and 6) were all students at the same racially-mixed, predominantly middle-class public school. There were 6 male and 10 female nursery school children (mean age 4.43; range 4.08 to 4.75), 10 male and 6 female first graders (mean age 6.57; range 6.00 to 7.50), 7 male and 9 female third graders (mean age 8.63; range 8.00 to 9.67), and 9 male and 7 female sixth graders (mean age 11.66; range 11.00 to 12.33). The data from one nursery school subject was discarded because he left the testing room before the end of the session.

Results

Picture Preferences

Table 1 presents the choices made for each possible pair of drawings. The alternative chosen is listed at the top of each column, and the rejected alternative is noted at the left of each row. Early trials are listed near the top and left, and later trials are near the bottom and right; the number in parentheses indicates how many times this trial occurred within the indicated age group. The scores were derived by pooling over sex, stimulus object, and mode of presentation (perception or memory), since no differences between or interactions with these variables were significant. Of particular interest is the failure to find any effects of mode of presentation, suggesting that the internal representations arising during perception resembled those in memory. If a child was asked both forms of the question on a given trial, his response to the second

form ("Which picture looks more like what we saw?") was the one counted, since this answer should reflect more accurately which drawing the child preferred as a representation of the perceptual qualities of the object. For first, third, and sixth graders, respectively, both questions were put to the child on 57, 37, and 15% of the trials, and answers were changed on 7, 6, and 3% of the trials; in contrast, the nursery school children were asked both questions on 98% of the trials, largely because they did not articulate a rationale for their initial choice. On 42% of these trials, these children changed their minds (changing from non-perspective to perspective, perspective to non-perspective, and changing within a category on 19, 9, and 14% of the trials).

See Table 1

The number of trials on which both forms of questions were used decreases significantly over age ($F(3,60) = 52.99$, $p < .001$), in part because the younger children often failed to verbalize clearly their reasons for choosing a particular answer. Further, the nursery school children were more prone to change their answers when given both questions than were older children ($F(3,60) = 13.07$, $p < .001$). In general, however, if the children changed their minds, they were more likely to select a perspective drawing after first having chosen a picture without perspective than vice versa (Friedman analysis of variance, $x_r^2 = 7.125$, $p < .04$.). Given that twice as many changes were made to a reference for perspective than from a perspective to a non-perspective drawing, one could argue that the children simply were responding to demand characteristics. To guard against this possibility we took special care in eliciting justifications from the children for those choices. We found that fully 65% of the nursery school children who changed their preference from a non-perspective to a perspective drawing gave a p[illegible]eptually-based explanation for doing so, while 22% gave another type of expl[illegible]tion and 13% offered no rationale for their choice.

The first ch[illegible] the only one necessarily made by all children, was between the conventional perspective and diagrammatic drawings. Two aspects of these data are striking: the very high percentage of perspective answers given by the first, third, and sixth graders, and the difference between these children and the nursery school subjects. The significance of this age difference was obtained by assigning each child a score of 0 to 4, based upon the number of perspective drawings he chose as a preferred representation of the target object. The mean number of perspective drawings chosen by the nursery school children was 3.00, while for all other grades, the mean was 3.94 drawings. A standard analysis of variance was then performed on the scores, and the age difference proved to be highly significant ($F(3,60) = 11.21$, $p < .001$). It should be noted that although the nursery school children chose the perspective drawings far less often than the older children, they still selected this type of picture 3 times out of 4. The question remains, however, why any child would select one of the diagrammatic representations, which seem, to most adults, to be poor depictions of the objects they supposedly represent.

First, it should be noted that if the nursery school children simply more often chose the drawings haphazardly, they would appear to "prefer" the diagrammatic renditions more often than the older children. It was for this reason that we tried to obtain from the children an explanation for their answers, and these are discussed below. More interestingly, perhaps the children who initially selected the diagrammatic drawing did so because of a preference for certain

individual characteristics of the picture that had nothing to do with a structural description. Perhaps, they preferred the diagrammatic picture simply because it was symmetrical, or because it had fewer oblique lines. To begin to test these possibilities, the second choice point paired the symmetrical perspective drawing with the child's selection from the first trial. This trial provided an opportunity for the children who had previously chosen the diagrammatic drawing to switch their preference to a perspective drawing, and about half (49%) of them did so. For the other subjects, this trial represented a choice between two different conventional methods of depicting perspective. There was a significant tendency for the number who selected the symmetrical perspective picture in this case to decrease with age ($F(3,60) = 5.94$, $p < .01$).

So far we primarily have been concerned with why some children selected the non-perspective drawing. It also is possible that the children who preferred the conventional perspective drawing in the earlier trials did so not because it was more in keeping with their internal representation, but because of specific properties of the picture. Perhaps the perspective was chosen because it always had more oblique lines, or was "more complex"; the complex perspective drawing was introduced to identify these children. This picture was chosen by relatively few children, primarily from the two youngest age groups. The number of children selecting an appropriate perspective drawing on this trial remained the same as in the first trial for all age groups except the first grade, where the percentage declined slightly. This was primarily due to the number of children who switched from non-perspective to perspective answers on Trial 2. Thus, it does not appear that the conventional perspective drawing was preferred merely because it had more oblique lines.

It is possible that the choice made on a given trial was a function of how prominent the outline of a side of the object was. Thus, in the fourth trial, a drawing of the front face of the object was presented. A large percentage of both the nursery school and first grade subjects (28% and 22%, respectively) indicated a preference for the front face drawing on this trial. The nursery school children had previously made an assortment of responses, but the bulk of the first graders who chose the front face drawing had previously chosen a picture drawn in perspective on the preceding trials. Several third grade children who also had previously selected only the conventional perspective drawing said they now preferred the front face representation.

Finally, the fifth trial was the last attempt to discover the basis for the children's preferences for some types of representation over others. If the child were making his decisions on the basis of how many sides of an object were depicted as undistorted by the rules of perspective, without regard to how they were connected, perhaps he would prefer a picture in which several unattached sides were shown together. Only one of the grade school children selected the multiple image drawing. In contrast, 23% of the nursery school children selected this picture.

Table 2 presents the combined responses for the final trial, irrespective of the responses that preceded them. The decrease in the selection of perspective pictures between the first trial (presented in the first column of Table 1) and the final trial was highly significant ($F(9,48) = 21.36$ $p < .001$), as was the increase in the number of perspective preferences with age ($F(3,48) = 13.79$, $p < .001$). In general, the attrition rate away from perspective drawings tended to be higher with the younger children, and this interaction was significant

($F(3,48) = 2.95$, $p < .05$). As is evident from Table 2, defections from perspective drawing were primarily to the front face and multiple styles.

See Table 2

In order to assess more accurately where the children were most likely to change their answers, we obtained change scores for each child and analyzed them. A subject was assigned a score of 1 for any trial on which he changed his preference from a perspective to another sort of drawing, and a score of 0 for all other trials. The younger the child, the more likely it was that he would switch his preference from a perspective drawing during the course of the experiment ($F(3,60) = 7.36$, $p < .001$). Additionally, any child, regardless of age, was most likely to switch his preference from a perspective drawing on a trial involving a front face drawing, next most likely to change when the drawing was complex, and least likely to chose a multiple drawing over a drawing with perspective ($F(2,120) = 6.27$, $p < .001$). Interestingly, although over half the children in all age groups who initially chose a perspective drawing maintained a preference for perspective to the end, only 21% of the children who initially chose the diagrammatic drawing selected this picture on all trials.

Explanation for Picture Preferences

The children's explanations of their preference for particular representations were coded according to the criteria described in Appendix A. Two independent judges rated the explanations, and they agreed 98.9% of the time; the few discrepancies were resolved through mutual agreement. Table 3 shows the percentage of the time each age group gave each type of response.

See Table 3

All age groups gave approximately the same number of general resemblance explanations (e. g., "It looks like what we saw") when attempting to justify their preference for perspective drawings ($\chi^2 = 3.84$, $p > .20$). Perspective preference based upon specific resemblance (e. g., "This picture is bent and the thing we saw was straight"), however, increase sharply between nursery school and third grade, with the sixth grade children giving approximately the same proportion of this type of explanation as do the third graders ($\chi^2 = 11.21$, $p < .02$). The number of orientation explanations (e. g., "The way we were looking at it, I could see the side, and the side shows in this one") also increases with age ($\chi^2 = 24.81$, $p < .001$). Not surprisingly, the number of trials on which no explanations is given decreases for the older children ($\chi^2 = 113.21$, $p < .001$). The explanations given for preferring non-perspective drawings fall into the same general pattern.

Because we are primarily interested in why some children preferred the diagrammatic drawing, we decided to look at the explanations of these children in more detail. A diagrammatic picture was preferred initially by 13 children on a total of 19 different trials. Six nursery school children and one child from each of the primary grades made such a choice on one trial, while 2 nursery school children selected a diagrammatic drawing for 2 objects; and an additional pair made such a choice for 3 objects.

Seven such choices, three from one child and two from another, reportedly were based on the belief that the diagrammatic picture showed more parts of the object

than did the conventional perspective. As would be expected, if a subject who gave this type of explanation switched his preference away from the diagrammatic drawing, he would choose the multiple drawing (which also had "more parts") when it was presented to him. Two children chose the diagrammatic figure because they felt it could be reconstructed as the stimulus object. Five children stated that the picture resembled the stimulus object, but did not elaborate on the specifics. Three children gave idiosyncratic responses, and one child offered no explanation on two trials.

Three children continued to prefer the same diagrammatic drawing through all five trials. One nursery school child, who preferred the diagrammatic pictures of both the "house" object and the "sticks" figure, explained on all trials that this type of picture showed more sides of the object. Another nursery school child, viewing the "house" figure, gave no explanation for his preference for the diagrammatic drawing until the final trial, when he said, "The shape has to be like that." The only grade school child to choose the same diagrammatic picture on all trials, a sixth grader, preferred the diagrammatic cube because it showed more sides.

The children's drawings

After obtaining the children's preferences for different methods of pictorial representation, we asked the children to draw the stimulus objects. It is of interest to consider the children's drawings in light of the types of preferences they expressed in the first part of the experiment for two reasons: First, we would like to see whether they seem to have been unduly influenced by the initial exposure to the different types of pictures. Second, we are interested in possible disparities between preference for and ability to produce a particular type of drawing. Four of the types of pictures presented in the initial phase of the experiment correspond to types of drawings actually produced by the children. These types of drawings are front face, diagrammatic, symmetrical perspective, and conventional perspective; examples of the children's drawings are presented in Figure 2, and described in Table 4.

See Figure 2 and Table 4

We first ascertained which children had drawn one or more of the stimulus objects in one of the four styles just mentioned. Two judges independently assigned the drawings to one of the categories presented in Figure 2; they agreed 95.7% of the time, and any disagreements were resolved through discussion. Then, we determined whether a child had preferred the drawing that matched his own picture when it was first presented. Thus, if a given child drew only the front face of the cube, we looked at the first trial in which he was shown the front face drawing, and noted which picture he preferred at that time. The results of this analysis are presented in Table 5, and the types of drawings produced for each stimulus object are listed in Table 6.

See Tables 5 and 6

Of primary interest is the finding that although a sizable percentage of children drew diagrammatic pictures, few of them preferred them previously. In fact, a diagrammatic picture was previously selected in only <u>one</u> instance of the 47 cases where diagrammatic pictures later were drawn. Thus, children were not simply drawing what they remembered preferring. Younger children who drew front

face renditions, and almost all children who drew conventional perspective pictures, however, did tend to prefer these types of representations earlier in the experiment. A much smaller percentage of the children who drew symmetrical pictures had made a corresponding selection during the earlier questioning.

For each of the four objects, the use of the artistic conventions of perspective drawing increases significantly with age (χ^2 = 50.81 for cube, 44.72 for "sticks" figure, 54.24 for "house" figure, and 57.32 for prism, $p < .001$ in all cases). In addition, for each of the four age groups, the types of drawings made of the different stimulus objects do not differ significantly from each other (Friedman analysis of variance, $p > .1$ for each grade). The differences between the grade school children illustrated here further attest to the fact that children were not simply drawing what they remembered selecting previously.

Many of the children's drawings seemed to us relatively poor representations of the depicted objects, but how did the children evaluate their own drawings? After finishing many of their drawings the children indicated their disapproval, sometimes rather forcefully. Disparaging comments occurred during or after completing a drawing for 30% of the nursery school children, 23% of first graders, 23% of third graders, and fully 33% of sixth graders (e. g., "I'm sorry, but that's the best I can do;" "Finished that rotten one, too."); the difference between the age groups was not significant ($p > .5$).

In closing, there are some interesting within category variations which can be seen in Table 6. Almost all of the children who drew one side of an object drew the distinctive one. No child drew a diagrammatic representation of a cube. No child simply added extra pieces to the basic shape of the "sticks" figure; that is, they did not try to represent extra sides of an object with only a top and bottom. The single-base perspective scheme was used only by older children and only with non-iterative objects. Finally, transparent perspective was used almost exclusively for cubes.

Discussion

The vast majority of children preferred a perspective drawing as the best depiction of an object's appearance, and almost all of these children explained their preference by referring to the physical resemblance between the stimulus object and the drawing. This was true whether the stimulus object was actually physically present or not. These data do not support the claim that children's memories are structured more like diagrams than pictorial images. Indeed, the fact that there were no significant differences between memory and perception conditions suggests that children have pictorial representations in memory. It is possible, however, that the conventions of perspective drawing are learned so early in our culture that most of the children we tested were no longer consulting their own internal representations when choosing the preferred form of depiction. The reasons that children gave to justify their responses argue against this interpretation, however. In fact, even among the three children who preferred a diagrammatic drawing throughout all five trials, the two who gave explanations did not emphasize the structural properties of the drawing; instead, they focused on the notion that the diagrammatic rendering showed "more" of the object. It is possible that these children simply seized on the word "more" in our question ("Which looks more like what we saw?"), and gave what they thought was the answer implied by that question.

Many behaviors served to indicate that the drawings were affected by problems

peculiar to the act of drawing, and not simply vagaries in the form of the internal representation. Several children drew 4 or 5 versions of the same picture, often almost identical to each other, before resigning themselves to the fact that they could not draw it the way they wanted to. Several children were able to describe verbally how the picture should look, but could not execute their description; some of the older children asked (in vain) to see again the stimulus drawings used in the first part of the experiment; and, many of the younger children traced the outline of the object with their finger and tried to duplicate the motion in drawing. In addition, many children predicted beforehand that they would not be able to draw a particular picture; this happened often when the younger children were faced with the prism or "house" figure, which necessarily entailed drawing diagonals. It should be mentioned, however, that some of the younger children not only did not predict their impending failure, but did not even seem to know what the outcome of their drawing would look like until it was completed. For example, one child, in drawing the "sticks" figure, drew his sticks in such a way that sticks from adjoining sides met in the center of the figure at right angles to each other. Every time this happened (four times in all), he was surprised!

The children did seem to intend drawings to be representational, but lacked the artistic competence to draw what they had in mind. This finding does not support Minsky and Papert's contention that the child is coding visual information purely in a symbolic fashion, without inclusion of information about the form of the proximal stimulus itself. Rather, the children seemed to have clear perceptual models which, unfortunately, they were unable to match with their drawings. It should be emphasized that the data do not, however, indicate that children internalize a complete "photograph" or model of an object. If this were so, why should so many children have switched preference from a perspective to a non-perspective front face drawing? In attempting to justify these choices, children often said that the side was a good representation of the entire object. In fact, for many children the object was named by the shape of its distinctive side (e. g., the prism was called a "triangle"). For the cube and sticks, children also sometimes commented that just knowing what one side looked like was enough to be able to identify the object. Clearly, children's internal representations are not passively absorbed replications of stimulation falling on the retina. Rather, children actively attend to various aspects of the stimulus, and selectively encode particular pictorial properties (c. f., Gibson, 1969). The end product of this encoding process does not, however, seem to be an abstract, "symbolic", diagrammatic description of the sort discussed earlier. This is not to say, however, that the child's internal representations are not ultimately composed of abstract propositions of the sort described by Pylyshyn (1973). The present data offer no way of making inferences about the ultimate, primitive form of representation. That is, even something as pictorial as a picture on a T. V. screen, for example, can be described in terms of whether each cell of a matrix is filled or not. Thus, an image could be composed of, or derived from, an underlying propositional representation (see Kosslyn, 1975; in press). The present data, however, argue against the claim that the functional representation is a simple description of parts and their relations, of the sort that would be most conveniently programmed into a machine.

In closing, our analysis of the children's drawings showed that their graphic works do not necessarily reflect their preferences or perceptions. Other variables enter into the act of drawing itself. As obvious as this last point is, it still seems necessary to make note of it in view of how childrens drawings

have been interpreted in the past. Further, the fact that so few children gave explanations or preferences at all like those reported anecdotally in the literature reinforces an old maxim: One should avoid making generalizations based on only one or two people's responses in uncontrolled settings. If workers in the field of artificial intelligence wish to gain insight and intuition from psychological findings, they should exercise care in the sort of data they are willing to accept as meaningful, or useful, let alone gospel.

APPENDIX A

The following scheme was used to classify the explanation the children gave for their drawing preferences.

1. General resemblance -- the child says that the stimulus object and the drawing look alike but does not specify what aspects of the two items resemble each other (e. g., "It looks like what we saw"; "It's the real box").

2. Specific resemblance -- the child states that the drawing and the stimulus object resemble each other in some particular way, such as the number of sides depicted or the direction and location of lines and angles (e. g., " 'Cause it's not crooked and the one that we saw wasn't crooked either"; " 'Cause this one you can't see exactly what, but that one has a back and a top to it").

3. Preference -- the child chooses a particular drawing, irrespective of its perceptual attributes, because it is aesthetically pleasing, or because it resembles some preferred object other than the one which is being presented to him (e. g., "It's pretty"; "Itlooks like a rocket and I like rockets").

4. Orientation -- the line of sight which is indicated in the drawing is believed to correspond to the angle at which the subject saw the stimulus object (e. g., "Because the way we were looking at it, it didn't zoom back like that").

5. Number -- the child prefers a drawing because of the number of objects it contains and makes no reference to how this number corresponds to the attributes of the stimulus object (e. g., "Those are four triangles"; There is more of these").

6. Other -- this category includes resemblance to other objects in which no preference is implied, non-verbal responses such as holding the picture up next to the object, and answers which fit no other category (e. g., "Because it's glasses, but only one eye"; 'Cause we can step on it").

7. No answer.

References

Arnheim, R. Art and visual perception. Berkeley: University of California Press, 1974.

Bruner, J. S., R. Olver, and P. M. Greenfield. Studies in cognitive growth. New York: Wiley, 1966.

Church, J. Language and the discovery of reality. New York: Vintage House, 1961.

Donaldson, M., and R. J. Wales. On the acquisition of some relational terms. In J. R. Hayes, Cognition and the development of language. New York: Wiley, 1970.

Kellogg, R. Analyzing children's art. Palo Alto: National Press, 1970

Kosslyn, S. M. Information representation in visual images. Cognitive Psychology, 1975, 7, 341-370.

Kosslyn, S. M. Can imagery be distinguished from other forms of internal representation? Evidence from studies of information retrieval times. Memory and Cognition, in press.

Kosslyn, S. M. and G. H. Bower. The role of imagery in sentence memory: a developmental study. Child Development, 1974, 45, 30-39.

Lewis, H. P. Spatial representation in drawing as a correlate of development and a basis for picture preference. Journal of Genetic Psychology, 1963, 102, 95-105.

Minsky, M., and S. Papert. Research at the lab in vision, language, and other problems of intelligence. Artificial Intelligence Memo, #252. M.I.T., 1972.

Moran, P. The symbolic imagery hypothesis: a production system model. Unpublished dissertation, Carnegie-Mellon University, 1973.

Olson, D. R. Cognitive development: the child's acquisition of diagonality. New York: Academic Press, 1970.

Piaget, J., and B. Inhelder. The child's conception of space. New York: Norton, 1956.

Pylyshyn, Z. W. What the mind's eye tells the mind's brain: a critique of mental imagery. Psychological Bulletin, 1973. Vol. 80, No. 1, 1-24.

Footnotes

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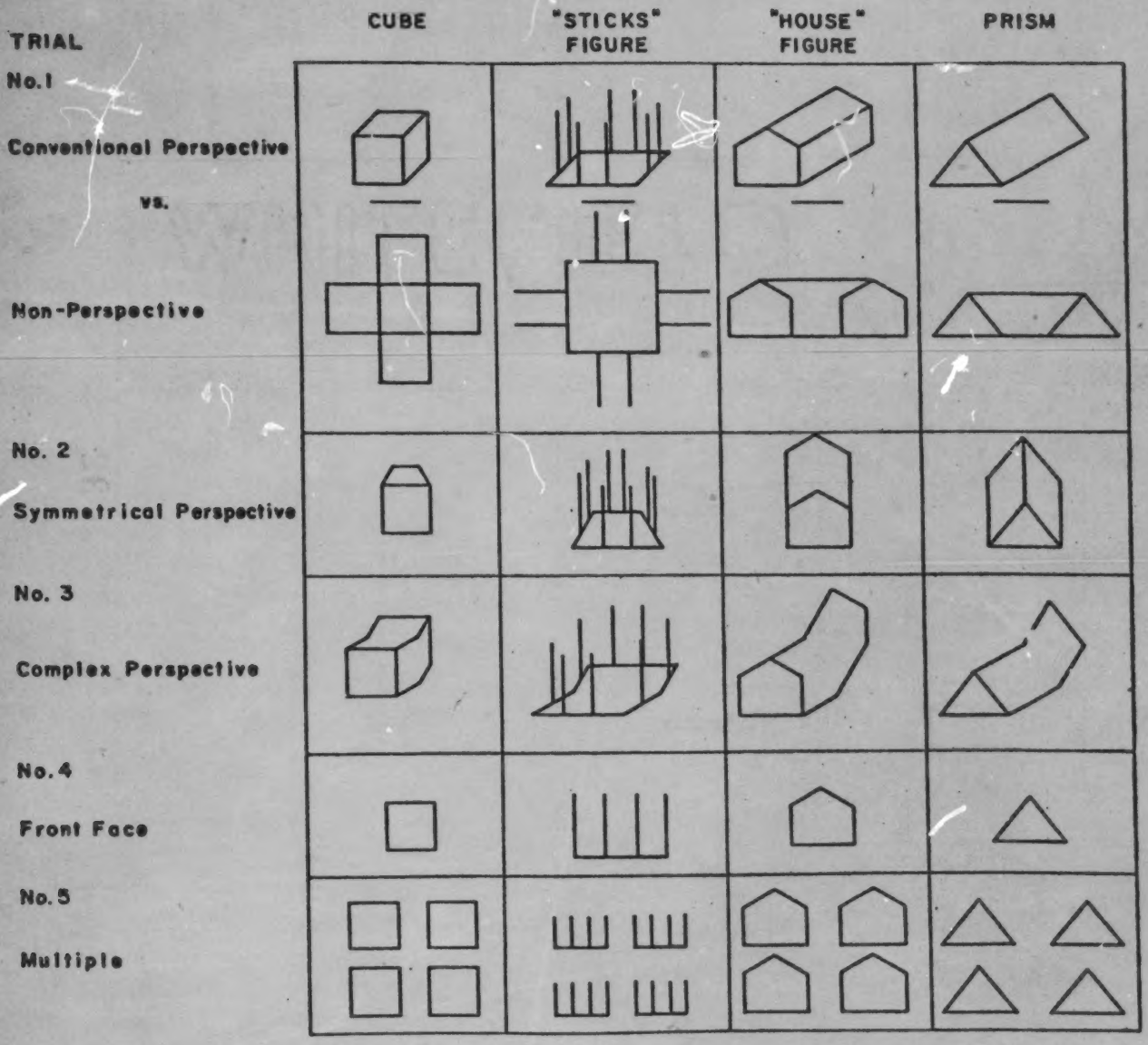
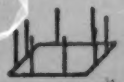
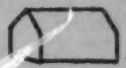
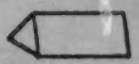
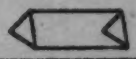
Figure 1: Stimulus drawings used on each trial for each object.



	CUBE	"STICKS" FIGURE	"HOUSE" FIGURE	PRISM
Conventional Perspective				
Symmetrical Perspective				
Transparent Perspective		—		
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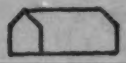
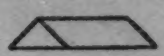
Single Base Perspective	—	—		
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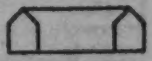
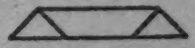
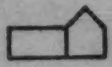
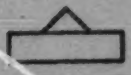
Non-Iterative Diagrammatic	—	—		
Side Plus		—		
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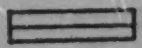
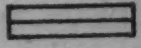
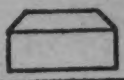
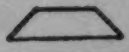
Aerial	—			
Non-Iterative-Distinctive Side	—	—		
Non-Iterative-Non-Distinctive Side	—	—		

Figure 2: Examples of the different types of drawings produced for each object. Descriptions of the types are presented in Table 4.

Table 1.

Percentage of chosen alternatives for each pair. The column heading is objects chosen, the row heading is the alternative rejected.

	Grade	Conventional Perspective	Diagrammatic	Symmetrical Perspective	Complex	Front Face	Multiple
Conventional Perspective	N	--	25% (16)	36% (23)	3% (2)	6% (4)	0 (0)
	1	--	2% (1)	31% (20)	3% (2)	16% (10)	0 (0)
	3	--	2% (1)	20% (13)	2% (1)	3% (2)	2%(1)
	6	--	2% (1)	17% (11)	0 (0)	2% (1)	0 (0)
Diagrammatic	N	75% (48)	--	11% (7)	8% (5)	2% (1)	0 (0)
	1	98% (63)	--	2% (1)	0 (0)	0 (0)	0 (0)
	3	98% (63)	--	2% (1)	0 (0)	0 (0)	0 (0)
	6	98% (63)	--	0 (0)	0 (0)	0 (0)	0 (0)
Symmetrical Perspective	N	39% (25)	14% (9)	--	8% (5)	11% (7)	3%(2)
	1	67% (43)	0 (0)	--	3% (2)	3% (2)	0 (0)
	3	78% (50)	0 (0)	--	0 (0)	5% (3)	0 (0)
	6	81% (52)	2% (1)	--	0 (0)	0 (0)	0 (0)
Complex	N	36% (23)	6% (4)	39% (25)	--	9% (6)	6%(4)
	1	64% (41)	0 (0)	30% (19)	--	3% (2)	0 (0)
	3	77% (49)	0 (0)	22% (14)	--	0 (0)	0 (0)
	6	81% (52)	2% (1)	17% (11)	--	0 (0)	0 (0)
Front Face	N	30% (19)	5% (3)	28% (18)	9% (6)	--	14%(9)
	1	48% (31)	0 (0)	27% (17)	3% (2)	--	0 (0)
	3	73% (47)	0 (0)	17% (11)	2% (1)	--	0 (0)
	6	80% (51)	2% (1)	17% (11)	0 (0)	--	0 (0)
Multiple	N	30% (19)	5% (3)	25% (16)	3% (2)	14% (9)	--
	1	48% (31)	0 (0)	27% (17)	3% (2)	22% (14)	--
	3	72% (46)	0 (0)	17% (11)	2% (1)	8% (5)	--
	6	80% (51)	2% (1)	17% (11)	0 (0)	2% (1)	--

Table 2

Percentage Choosing Each Drawing on Final Trial

Grade	Conventional Perspective +	Symmetrical Perspective =	Total Perspective	Diagrammatic	Complex Perspective	Front Face	Multiple
Nursery	30%	25%	55%	5%	3%	14%	23%
1	48%	27%	75%	0	3%	22%	0
3	72%	17%	89%	0	1%	8%	1%
6	80%	17%	97%	1%	0	1%	0

Table 3

Children's Explanations of Drawings

Grade	Specific Resemblance	Orientation	General Resemblance	Number	Preference	Other	No answer
Nursery							
Perspective	13%	0	31%	1%	6%	5%	19%
Non-perspective	5%	0	7%	1%	2%	6%	5%
First							
Perspective	44%	0	29%	4%	1%	1%	8%
Non-perspective	6%	1%	2%	3%	1%	0	1%
Third							
Perspective	52%	4%	24%	7%	4%	2%	3%
Non-perspective	3%	0	1%	1%	0	0	0
Sixth							
Perspective	53%	5%	26%	7%	1%	4%	2%
Non-perspective	2%	0	0	0	0	0	0

Table 4

Description of the categorization scheme used to classify the children's drawings.

1. Perspective drawings

   a. conventional perspective -- the standard way of rendering perspective in our culture, with the front face shown perpendicular to the line of sight and the side represented at an angle of approximately 45° to the front

   b. symmetrical perspective -- a side or corner of the object is shown perpendicular to the line of sight with the top receding toward the background, and the figure is symmetrical about the midline

   c. transparent perspective -- perspective drawn as if all sides of the object were transparent, with the intersection of all planes visible

2. Transitional perspective 1

   a. elaborated perspective -- the application of standard rules of perspective drawings to the depiction of three sides and the entire top of an object in one picture

   b. single base perspective -- similar to conventional perspective, except that the bases of the two sides constitute a single line

3. Transitional perspective 2

   a. diagrammatic -- this is different for iterative and non-iterative figures

      i. iterative -- a symmetrical arrangement of all sides around one of the bases

      ii. non-iterative -- both distinctive sides joined by a non-distinctive side or the top

   b. side plus -- a grouping of one or more sides of an object with additional geometric pieces appended to it, which does not fall into any of the categories listed above

4. Side only -- one side of the object

   a. aerial -- a top view of the object

   b. for non-iterative figures there are two sub-categories

      i. distinctive side -- the side of the object which differentiates it from other objects with rectilinear sides

      ii. non-distinctive side -- the side of the object which does not differentiate it from other non-iterative objects

Table 4 (continued)

5. Closed contour -- a single closed contour other than one in the object being depicted

6. Scribble -- marks on a paper, with no one major closed contour

7. No picture

Table 5

Comparison of Children's drawings with Children's Preferences

	Front Face			Diagrammatic			Symmetrical Perspective			Conventional Perspective		
Grade	#drawn	#selected	%	# drawn	# selected	%	# drawn	# selected	%	#drawn	#selected	%
N	28	11	39%	5	0	0	0	0	-	0	0	-
1	24	5	21%	18	0	0	2	0	0	5	5	100%
3	14	2	14%	16	1	6%	5	0	0	9	9	100%
6	4	0	0	8	0	0	12	3	25%	27	26	96%
Total	70	18	26%	47	1	2%	19	3	16%	41	40	96%

Table 6

Children's Drawings: Iterative Objects

Type of Drawing	Cube N	Cube 1	Cube 3	Cube 6	"Sticks" Figure N	"Sticks" Figure 1	"Sticks" Figure 3	"Sticks" Figure 6
Conventional Perspective	0	6%	19%	37.5%	0	0	6%	19%
Symmetrical Perspective	0	0	0	6%	0	6%	12.5%	31%
Transparent Perspective	0	12.5%	37.5%	81%	0	6%	19%	50%
Elaborated Perspective	0	12.5%	0	0	0	0	0	0
Single Base Perspective	0	0	0	0	0	0	0	0
Total Transition 1	0	12.5%	0	0	0	0	0	0
Diagrammatic	0	0	0	0	31%	75%	62.5%	44%
Side Plus	0	25%	19%	6%	0	0	0	0
Total Transition 2	0	25%	19%	6%	31%	75%	62.5%	44%
Side	69%	50%	44%	12.5%	19%	19%	19%	6%
Distinctive Side	0	0	0	0	0	0	0	0
Non-distinctive Side	0	0	0	0	0	0	0	0
Aerial	0	0	0	0	12.5%	0	0	0
Total Side	69%	50%	44%	12.5%	31%	19%	19%	6%
Closed Contour	31%	0	0	0	25%	0	0	0
Scribble	0	0	0	0	12.5%	0	0	0
No Picture	0	0	0	0	0	0	0	0

A DEVELOPMENTAL STUDY OF GESTALT PROCESSES IN PATTERN RECOGNITION

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Arnold L. Glass, Rutgers University

Abstract

The present experiments were designed to investigate the development of pattern recognition processes. In particular, we were interested in the development of the Gestalt principles of perceptual organization at work in this task. In one experiment both adults and children studied 12 nonsense line drawings and later were asked to attempt to recognize "good" and "bad" parts of the drawings. A "good" part was composed of lines which formed structural units of a drawing, as determined by Gestalt principles, whereas the lines comprising a "bad" part did not form structural units of the corresponding drawings. Both adults and children recognized more good parts than bad parts, and the relative advantage of good parts was about the same over age. In the second experiment, we again presented children and adults with 12 drawings, but this time the segments of the line drawings used to construct "bad" parts now were colored differently from the rest of the figure. Adults now recognized slightly more "bad" parts than "good" parts, but the children were unaffected.

A large part of the process of perceptual development consists in discovering what are the relevant parts of objects (see Gibson, 1969). But how do we know what constitutes a part? Further, are the portions of objects that are seen as separate parts by children necessarily the same as those seen as parts by adults? The present paper is an attempt to explore these questions.

The Gestalt psychologists (e.g., Kohler, 1947; Wertheimer, 1938) proposed a number of rules, the "Laws of Perception," by which a pattern is segmented into a set of nonoverlapping parts. These parts presumably correspond to the underlying structural units encoded into memory when one views a pattern. The Gestalt laws of perception are supposed to reflect fundamental properties of the mind, rather than being the product of experience. This notion leads one to expect the Gestalt laws to characterize the perceptual processes of children as well as adults.

Bower (1971) provides evidence that even very young infants' perceptions of patterns conform to certain Gestalt principles (the principle of good continuity and the principle of common fate). However, these results provide far from a complete picture of the development of pattern perception processes. First, Bower finds that another Gestalt principle, the principle of proximity, appears not to function as a grouping principle until the child is one year old. Second, Bower's patterns and response measures are necessarily quite simple, and leave open the role that learning and/or maturation might play in the application of individual Gestalt principles to more complex patterns. Finally, Bever (1971), Papousek (1967), and others have shown that the course of development is often not a monotonic one. For example, innate ballistic motor responses present near birth often disappear, to be replaced by learned movements later (see Bower, 1971). Therefore, it is important to test an ability across

a range of ages, and not to assume that older children will perform well or better than those who are younger.

The purpose of this investigation was to explore the role of Gestalt principles in pattern recognition in 6-year-olds and adults. Children of this age were selected because of the previously garnered evidence that perceptual processing seems to undergo a major improvement in children around the age of seven (e.g., Gibson, 1969; Vurpillot, 1968; White, 1965). The development of pattern recognition processes seemed especially worthy of study because pattern recognition is intimately bound up with so many other psychological processes, ranging from concept formation to language acquisition and use. The methods and materials used were adapted from a recent study by Bower and Glass (in press). Bower and Glass formalized the Gestalt principles of "good continuity" and "common fate" (see Wertheimer, 1938), and used their set of rules to parse a set of patterns into structural units. In their first experiment, they found that such a structural unit was about five times as effective as a recall cue for the entire original pattern than a part of the pattern equal in area to the structural unit that was not itself a structural unit. In their second experiment, they found that two patterns containing the same structural units were more confusable in a recognition task than two patterns containing different structural units.

The first experiment reported here modified the materials of Bower and Glass for use in a recognition task. First, adults and children were shown a set of study patterns. They were then shown a pair of test patterns, and were asked to choose which of the two patterns was part of a study pattern. On each trial, one of the two patterns was a part of a study pattern. All the study patterns and test parts were taken from the first experiment of Bower and Glass. There were two kinds of parts of patterns used. The "good parts" corresponded to the good recall cues of Bower and Glass, i.e., they corresponded to a priori defined structural units of the study patterns. The "bad parts" corresponded to the bad cues of Bower and Glass; i.e., they did not correspond to any structural units of the study patterns. It was predicted that both adults and children would recognize significantly more of the parts organized according to the principles of good continuity and common fate (good parts) than patterns not so organized. Furthermore, if the rules are operating to the same extent in children and adults, then the relative advantage in recognizing good parts over bad ought to be about the same over age.

Experiment 1

We tested the idea that a part corresponding to a structural unit of the study pattern (a good part) would be more likely to be later recognized as a bona fide part than a part not corresponding to a structural unit of the pattern (a bad part). Two study patterns, along with their good and bad parts and distractors, are shown in Figure 1. The study pattern in Figure 1A contains the structural units (ABCD), (EFGH), (JK), and (MN) while the good part for it contains the units (ABCD) and (JK). Similarly, the study pattern in Figure 1B is parsed into four vertical lines cut by a diagonal and its good part is parsed into two vertical lines cut by a diagonal. Bad parts, on the other hand, are "misleading" because the parsing rules assign to them structural units which do not correspond in any way to the units of the original pattern. For example, the two jagged lines in the bad part in Figure 1A each comprise a structural unit that does not exist in the study pattern. Similarly, in Figure 1B, the

diagonal segment and the vertical segments that are members of a single structural unit in the bad part belong to different structural units in the study pattern. A detailed description of how the patterns are parsed into descriptions is given in Bower and Glass (submitted).

Also shown in Figure 1 are the distractors presented with each part. Initially, three distractors were constructed for each part. Thirty-six Johns Hopkins students rated the distractors (on a standard 7-point scale) in terms of how similar they were to the corresponding "good" or "bad" part. Every good part and the distractor paired with it in the experiment were rated on the average to be slightly more similar to each other than was the case for the bad parts and their distractors. This procedure insured that any advantage in recognizing good parts could not be attributed to how easily the distractor was rejected.

Method

Materials

The twelve original study patterns, the good and bad parts, and the distractors, were originally drawn with a black felt tip pen on white cardboard 2.3 x 3.0 cm. A tracing procedure was used so that each part appeared exactly the same as in the original pattern. Then, all drawings were transferred to dittos and reproduced as blue lines on white paper. The twelve study patterns were randomly ordered and bound together in a booklet. Immediately in front of each pattern was a blank page, which prevented a subject from seeing through one drawing to the one following it. The parts and distractors were mounted in a second booklet such that a part and its distractor were on opposite pages, facing each other. Half of the good and bad parts appeared on the left, and half appeared on the right. Half of the good parts appeared before the bad part for the same study pattern and half the good parts appeared after the corresponding bad part. The parts were collated in approximately the same order as the study patterns, except for the fact that parts of adjacent study patterns were interleafed so that both parts of the same pattern never appeared successively in the test booklet.

Procedure

Subjects were tested in small groups. They were told that they soon would see some drawings, and should try to remember what they looked like. The experimenter would tell them when to look at a new drawing, and they should wait until told before turning the page. Following this, subjects viewed each drawing for about 5 sec (prompts to turn the page were given every 7 sec for the children and every 6 sec for adults, the additional time given children was deemed necessary as they tended to turn the pages more slowly).

After all study patterns has been viewed, subjects returned the study booklets. The test booklets were now distributed. The subjects were asked not to open these booklets until told to do so. Subjects were then informed that the booklets contained parts of pictures, and that two parts could be seen at the same time on pages that faced each other. For every pair, only one of the two parts actually was taken from a picture that they had just seen. They were told to indicate which one was from a picture by making an "x" under that part, If a subject wasn't sure, he or she was to guess. Following this, an example was

given. First, a pattern not included in the twelve seen previously was shown. Then, a pair of test patterns consisting of a good part of the pattern just shown and a distractor were presented. The subjects were asked which of the two parts was taken from the picture just shown. The study pattern was exposed again and the location of the good part was pointed out. Then, the bottom of the page containing the good part was marked. Next, a second pair of test patterns consisting of a bad part and distractor for the study pattern was shown, and the procedure was repeated. Questions were solicited and misconceptions were corrected. At the conclusion of the instructions and example, everyone seemed to understand the task. Subjects then were told to examine the pairs in the booklet before them, marking which page contained the correct test pattern. This task was self-paced, but subjects were not allowed to view a pair a second time.

Subjects

Eleven children (ages 6.0 to 7.4, mean 6.4), 5 boys and 6 girls, were tested. These children attended a racially mixed, predominantly middle/upper-middle class elementary school. The adult subjects, 2 males and 9 females, attended Johns Hopkins University or Goucher College.

Results and Discussion

In all analyses reported in this paper, correct choices were scored as 1 and incorrect choices as 0; these data were then considered in an analysis of variance.

Adults recognized 85% of the good parts and 67% of the bad parts, while children recognized 67% of the good parts and 48% of the bad parts. Hence, both adults and children recognized good parts better than bad parts ($F(1,20) = 27.17$, $p < .001$). In addition, the adults' performance was generally superior to the children's ($F(1,20) = 18.88$, $p < .001$). The advantage of good parts over bad was about the same over age, as indicated by the fact that there was not a significant interaction between age and part-type ($F < 1$).

The results of Experiment 1 indicate that adults and children segment some patterns in similar ways. Hence, by age six some processes that govern pattern recognition in adults have developed. However, the stimulus materials used in this task were extremely impoverished. In the real world, the internal structure of objects may be delineated by variation ofnot just contour, but of other dimensions as well. The following experiment replicates the design of the first, but uses slightly more enriched stimuli.

Experiment 2

In this study, new groups of adults and children were presented with the same study patterns used in the first experiment. But this time, the segments of the patterns corresponding to bad parts were colored dark blue, while the remainder of the pattern was colored a very light red. All of the pairs of test patterns used in later testing were also colored blue. We expected the principle of similarity to induce adults to encode the parts of the study pattern that were the same color as members of the same structural units. If a bad part (according to continuity of form and common fate) is encoded separately as

a unit when the study pattern is initially presented, recognition of bad parts ought to improve greatly relative to performance in Experiment 1. For example, if the fact that (AJK) and (MNE) are colored differently induces an adult to encode them as structural units, then recognition of the bad part of the study pattern in Figure 1A should improve. Conversely, the new organization induced by the color similarity should debilitate recognition of the good parts, since their structural units will no longer correspond to those of the study pattern. For example, in Figure 1A, if (AJK) is a structural unit, then (ABCD) cannot be a structural unit, and thus the structural units of the "good" part no longer correspond to those of the study pattern itself.

In contrast to the adults, we did not expect the color variation to affect children's performance. Many researchers (e.g., Brian and Goodenough, 1929; Kagan and Lemkin, 1961; Suchman and Trabasso, 1966) find that the potency of color in attracting the child's attention varies over age, and is less effective than form variation in the age range of six to eight. If an organization dictated by the form of a drawing conflicts with one dictated by common coloring, we expected the children to attend to form over color. Thus, it seemed unlikely that the principle of similarity would operate to induce children to organize the patterns in terms of the homegeneously colored areas. Therefore, we did not expect the children to recognize the bad parts more often than in the first experiment, wherein color variations were not presented. Similarly, we expected children, again in contrast to adults, to recognize the good parts in the test phase as frequently as in Experiment 1, even though a good part now contained segments that were initially colored differently.

Method

Materials

Study booklets were used that were identical to those in Experiment 1 in all respects other than the fact that the portions corresponding to bad parts were dark blue and the remainder was light red in color. The same test booklets used in Experiment 1, containing pairs including a correct part and a distractor, both in blue ink, also were used here.

Procedure

The procedure was identical to those of Experiment 1.

Subjects

Eleven children (ages 6.2 to 7.7; mean age 6.6), 6 boys and 5 girls, were tested. These children were drawn from the same population as those of Experiment 1. The adult subjects, 4 males and 7 females, also were from the same population as those of Experiment 1. None of the subjects who participated in the previous experiment, however, took part in Experiment 2.

Results and Discussion

Data were analyzed as in Experiment 1. Adults now recognized 70% of the good parts and 74% of the bad parts; children, in contrast, recognized 64% of the good parts but only 55% of the bad parts. These effects of part type were reliably different for the different ages, as documented by a significant in-

teraction between part type and age ($F(1,20) = 4.56$, $p < .05$). In addition, adults generally recognized more parts correctly than did the children ($F(1,20) = 5.08$, $p < .05$).

In order to examine more fully the interaction between part type and age, data from both experiments were combined and analyzed separately for each age. For the adults, the effects of part type were reliably different in the two experiments; recognition of bad parts improved in the second experiment, but recognition of good parts suffered ($F(1,20) = 12.36$, $p < .01$). For the children, in contrast, the effects of part type were the same in the two experiments (for the interaction, $F(1,20) = 1.99$, $p > .1$). No other differences between the two experiments were evident in these analyses. Finally, an analysis of all the data together was performed. Unfortunately, the interaction between part-type, age, and experiment failed to reach an acceptable level of significance ($F(1,40) = 1.52$, $p > .1$). Since this effect was not specifically predicted, we do not feel that this failure detracts from the results of the previous analyses.

As expected, then, for adults the principle of (color) similarity played a significant role and they often encoded together configurations of lines that were the same color. This occurred even though the commonly colored portions of patterns were defined as bad parts by other Gestalt principles of structure. In fact, the coloring disrupted the organization defined by the structural variables that had proved so potent in Experiment 1. The children, in contrast, performed no differently than in Experiment 1, where the patterns were colored uniformly.

General Discussion

While processing of patterns by children and adults appears to conform to some of the same general Gestalt principles, it is clear that adults and children do not process patterns in the identical manner. Bever (1970) has contrasted adult flexibility with child rigidity in perceptual strategies. This difference was apparent in the second experiment, where adults now made use of color information in organizing the units of a pattern but children did not. The children's failure to make use of color information could have been a consequence of their not encoding it initially. Alternatively, they may have encoded the color variation, but simply not made use of it in organizing the drawings. The children in Experiment 2 were asked after the experiment to name which colors were included in the original drawings; all of them noticed that both red and blue occurred. Thus, the first explanation seems rather implausible. E. Rosch (personal communication) has suggested that children may not use color information in tasks like ours because the color of an object is not consistently correlated with other features of the object. This is, she suggests (see Rosch, in press) that most features group into highly correlated clusters (e.g., wings, feathers, beaks often occur together); color, in contrast, does not often cluster with other sorts of features, and thus is a poor index of the likelihood of other given features being present. Hence, it does not behoove the child who is learning about new categories of objects to be overly attentive to color variation. This notion, however, does not account for why children younger than those used in our experiments do seem to pay attention to color; E. Clark (personal communication) suggests, interestingly, that this tendency may simply reflect the fact that younger children are just learning color names and color categories.

The results of our two experiments, then, indicate that pattern perception develops systematically, and over a period of time, rather than existing fully developed at birth or shortly thereafter. Whether or not this development is a consequence of experience, maturation, or some interaction between them is, of course, unanswerable given only the present data. The important point, it seems to us, is that even the fundamental laws of perception do not all seem to operate at an adult level by age six. The child's perception of the world may in fact differ from the adult's in ways previously unexplored. Some obvious next steps to be taken include enriching the patterns in additional ways, adapting the experimental paradigm for use with younger childre, and discovering at what age children utilize different sorts of information in parsing picture into component structural units.

References

Bever, T.G. The cognitive basis for linguistic structures. In J.R. Hayes (ed.) Cognition and the Development of Language, New York: John Wiley, 1970.

Bower, T.G.R. Development in Infancy. San Francisco: W. H. Freeman, 1974.

Bower, G.H. & Glass, A.L. Picture parsing processes and pattern recognition. Journal of Experimental Psychology: Human Learning and Memory, in press.

Brian, C.R. & Goodenough, F.L. The relative potency of color and form perception at various ages. Journal of Experimental Psychology, 1929, 12 197-213.

Gibson, E.J. Principles of Perceptual Learning and Development. New York: Appleton-Century-Crofts, 1969.

Kagan, J. & Lemkin, J. Form, color, and size in children's conceptual behavior. Child Development, 1961, 32, 25-28.

Kohler, W. Gestalt Psychology. New York: Liveright, 1947.

Papousek, H. Experimental studies of appetitional behavior in human new borns and infants. In H.W. Stevenson, E.H. Hess, and H.L. Rheingold (eds.), Early Behavior, New York: John Wiley, 1967.

Rosch, E. Classifications of real-world objects: origins and representations in cognition. In S. Ehrlich and E. Tulving (eds.), Bulletin de Psychologie, (special issue on semantic memory), in press.

Suchman, R.G. & Trabasso, T. Color and form preference in young children. Journal of Experimental Child Psychology, 1966, 3, 177-187.

Vurpillot, E. The development of scanning strategies and their relation to visual differentiation. Journal of Experimental Child Psychology, 1968, 6, 622-650.

Wertheimer, M. Laws of organization in perceptual forms. In W.D. Ellis (ed.) A Source Book of Gestalt Psychology, New York: The Humanities Press, 1938.

White, S.H. Evidence for a hierarchical arrangement of learning processes. In L.P. Lipsitt & C.C. Spiker (eds.), Advances in Child Development and Behavior, New York: Academic Press, 1965.

Footnote

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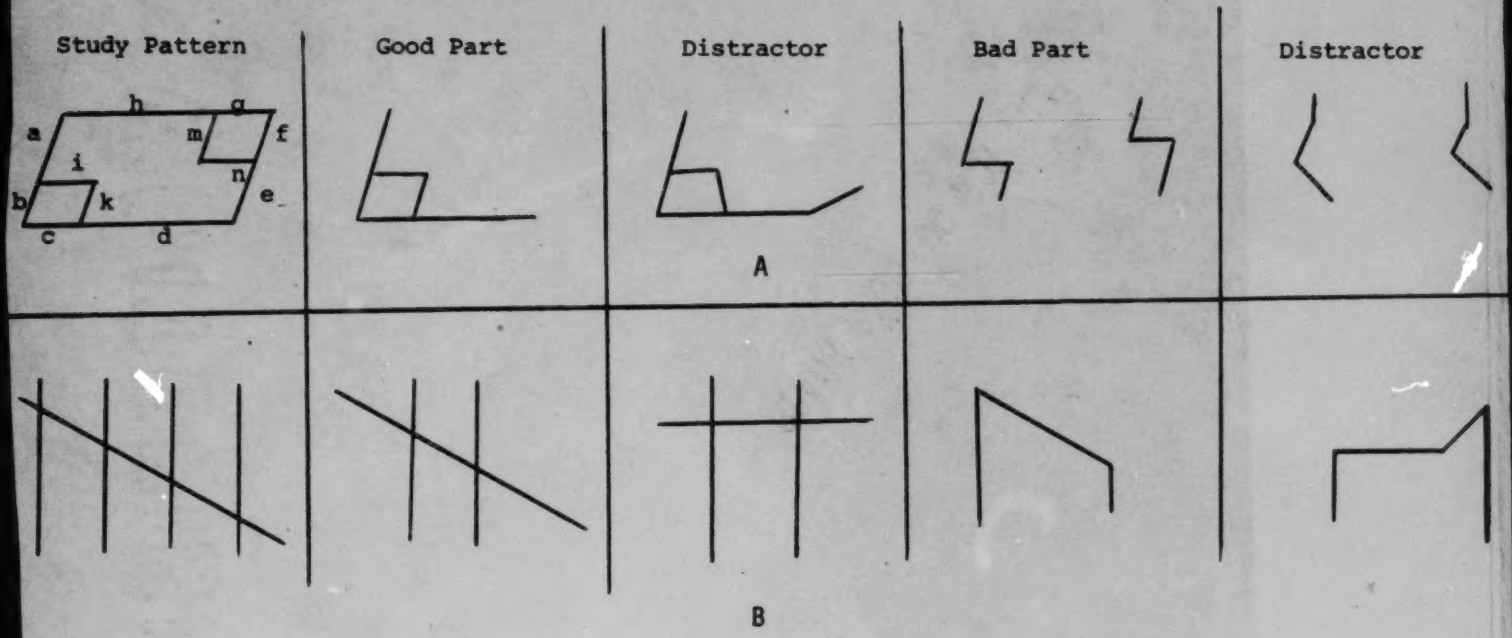
Figure Caption

Figure 1. Examples of initially presented patterns and subsequently presented parts plus their distractors. The small letters label segments of the drawings.



VISUAL MODALITY AS A PREFERRED MODE OF PRESENTATION FOR PIAGETIAN MORAL INTENTIONALITY

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Abstract

Twelve male and twelve female children between the ages of four and six years were presented Piagetian moral intentionality stories to determine if there was a difference in the number of intent-based responses given when stories were presented visually, as opposed to verbally. Each of three Piagetian-adapted stories were presented in three different ways. Intent was varied, but damage was either high, low, or alternated simultaneously with intent. A significant difference in the number of intent-based responses between the two modes of presentation was found when intent was varied but damage held constant; no significant difference was found when damage and intent were varied simultaneously. It was concluded that although visual presentation significantly increased the number of intent-based responses, generalizations should be limited until the locus for that change in responding is determined.

Piaget (1932) proposed that moral judgment develops through sequential stages in which the young child judges moral situations on quantity of damage alone, without consideration for intent (Pre-operational moral development); and the older child judges moral situations on the basis of both quantity and intentionality (Concrete operational development). Piaget demonstrated this developmental theory by verbally presenting children stories in which a well-intentioned act resulted in a great deal of material damage, while a bad-intentioned act resulted in a small amount of material damage.

Current research tends to support Piaget's hypothesis. Hebble (1971) reported that replication of Piaget's development of intent-based judgment lends support to the original hypothesis. King (1971) reported a similar developmental trend in intentionality concepts of young children in resistance to deviation. Both investigators employed Piaget's original experimental paradigm.

It was suggested that, in order to provide more generalizable data, a visual modality should be included in the evaluation of moral development. Current investigations add support to this hypothesis by indicating that children respond more accurately and have greater recall for visually presented, than for verbally presented, material (Entwisle, 1973; Ingison, 1975; Rohwer, 1975).

Considering the available literature supporting the salience of a visual modality for young children, it was hypothesized that a greater instance of change from damage to intent-based responding would be demonstrated by those children presented intentionality stories through visual media, as compared to children presented stories through verbal media.

Method

Subjects and Materials

Subjects were 24 children (12 male and 12 female) between the ages of four and six years old attending Towson State University's Lida Lee Tall Elementary School.

Materials consisted of six adaptations of Piaget's moral intentionality stories. Each story was used in three situations. In one situation intent (good-bad) was varied, but damage remained high. In a second situation intent again was varied, but damage remained low. The third situation was the traditional Piagetian task where both good and bad intent and high and low damage varied simultaneously.

In addition to the verbal stories, those stories presented during the experimental condition were accompanied by cartoon characters showing the intent and damage consequences.

Procedure

Interviewing was accomplished in a private room. Each child was told that he would be read (or read and shown) stories which, although sounding alike, differed slightly. Following each story presentation the child was asked which character in the story was worse, and why. Name choice and verbal reasoning were recorded and rated as either damage or intent based.

Pre-test

The pre-test consisted of the verbal presentation of three stories and questions. The purpose of the pre-test was to obtain the child's level of moral development as being pre-operational.

Experimental Condition

Selected children were randomly divided into two groups with six males and six females in each group, and were randomly assigned to either a verbal (Ve) or a Visual (Vi) condition. A 2 x 3 factorial design (Mode of presentation x Damage) with repeated measures on the second factor was used.

The experimental condition followed the pre-test by at least seven days. Children assigned to the Ve condition were verbally presented stories; children assigned to the Vi condition were provided both verbal presentations and pictures.

Results

Results were analyzed with all three conditions of damage (high, low, alternated) considered together; with intent varied but damage held constantly high or low; and with both intent and damage varied simultaneously.

The mean number of intent and damage responses given by children in both the Ve and Vi groups are presented in Table 1. These results show that, overall, more responses were made on the basis of damage than on the basis of intention-

ality, regardless of mode of presentation.

See Table 1

A mixed two-way factorial analysis of variance (Mode of Presentation x Damage) was performed on intent based responses for all three conditions of damage. As hypothesized, intent responses, F (1, 22) = 6.86, $p < .05$, occurred significantly more often under visual than under verbal conditions of presentation.

See Table 2

Conflicting results were reported when responses were analyzed separately under conditions where intent was varied but damage held constantly high or low, and under conditions where both intent and damage were varied simultaneously. A mixed two-way factorial analysis of variance (Mode of Presentation x Damage) performed on the verbal responses based on intent with damage held constant indicated that although more responses were made on the basis of damage for both presentation conditions, there was a significant change in the number of intent-based responses under the visual condition, F (1, 22) = 6.68, $p < .05$.

However, a Fisher Exact Probabilities Test performed on the verbal responses based on damage under conditions where both intent and damage were varied simultaneously, indicated that there was no difference between the visual and verbal presentation groups as a result of mode of presentation, $p > .2465$.

The conclusions of these analyses under separate conditions (damage held constant and intent varied vs. both damage and intent varied simultaneously) suggest that for young children moral judgments are made on the basis of damage more often than on the basis of intent. When intent and damage are varied simultaneously, children make judgments on the basis of damage regardless of mode of presentation. However, when damage is held constant and only intent varied, there is a significant change from damage-based responding to intent-based responding when presentation is made visually as compared to verbally.

Discussion

As hypothesized, there was a significant change from damage to intent based responses as a result of the visual presentation. That change, however, was apparent only when intent was varied but damage held constant, and not when both intent and damage varied simultaneously. Additionally, more responses were made on the basis of damage, regardless of mode of presentation or variation of damage.

Support was obtained for Piaget's hypothesis that pre-operational children attend only to damage, since more responses were made on the basis of damage, regardless of mode of presentation or variation of damage. A change from damage to intent responding when the material was presented visually was consistent with a theory of visual cue saliency. The result that a change in responding was apparent only when intent varied but damage was held constant demands an explanation separate from either Piaget's pre-operational egocentricism, or visual cue saliency.

One alternative might be that the intent component was available, but the young child was unable to verbalize that component. Bruner (1964) suggests that children develop from being governed primarily by perceptual attributes (damage) to becoming more receptive to conceptual attributes (intent). The conceptual ability is available, but because of the integral relationship between conceptual ability and language development, an inability to verbalize the conceptual basis makes the young child dependent upon reporting perceptual aspects.

Whether the effect reported in this investigation is the result of pre-operational egocentricism, visual cue saliency, an inability to verbalize the conceptual component, or some additional explanation is still to be determined. Generalizations should, therefore, be limited at present.

References

Bruner, J.S. The course of cognitive growth. American Psychologist, 1964, 19, 1-15.

Entwisle, D.R. & Huggins, W.H. Iconic memory in children. Child Development, 1973, 44, 392-394.

Hebble, P.W. The develcpment of elementary school children's judgment of intent. Child Development, 1971, 42, 1203-1215.

Ingison, L.J. & Levin, J.R. The effect of children's spontaneous cognitive sets on discrimination learning. Journal o. Experimental Child Psychology, 1975, 20, 59-65.

King, M. The development of some intention concepts in young children. Child Development, 1971, 42, 1145-1152.

Piaget, J. The Moral Judgment of the Child. Glencoe, Illinois: Free Press, 1948 (Originally published in 1932).

Rohwer, W.D. & Harris, W.J. Media effects on prose learning in two populations of children. Journal of Educational Psychology, 1975, 67, 651-657.

Table 1

Mean Number of Intent and Damage Responses
by Children in Verbal and Visual Groups

Group	Responses	
	Intent	Damage
Verbal		
High Damage	.08	2.92
Low Damage	.08	2.92
Alternated Damage	.00	3.00
Visual		
High Damage	.67	2.33
Low Damage	1.00	2.00
Alternated Damage	.17	2.83

Note: Maximum responses for each subject: 9

Table 2

Analysis of Variance

Source	df	MS	F
Mode of Presentation (M)	1	5.56	6.86*
Error	22	.81	
Damage (D)	2	1.29	5.38*
M x D	2	.85	3.54*
M x Error	44	.24	

* $p < .05$

DEVELOPING SKILLED READING THROUGH CHUNKING OF DISTINCTIVE FEATURES

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Abstract

In pursuing the purpose of the paper, to show that skilled reading can be developed through the chunking of distinctive features, the measurement of visual short-term memory and the chunking of distinctive features are discussed. Two visual short term memory tests, one for non-reading and reading elementary school children and one for college students, are considered. The distinctive features at four levels of reading are identified and the chunking of these features are explained, with experimental evidence presented to show that the chunking of distinctive features can lead to skilled reading.

This paper presents the notion that skilled reading can be developed by chunking distinctive features.

As an initial step towards substantiation of this notion, a common basis of understanding should be established. To this end, the terms skilled reading, chunking, and distinctive features are defined and discussed. Skilled reading is done silently to obtain meaning and to learn from written symbols, be they alphabetic or logographic. In this sense, reading is used here synonymously with learning, although it is recognized that not all reading results in learning and not all learning is the direct result of reading. As a learning process, reading should lead to non-reading; that is, as more and more of the information is learned, less and less reading should be necessary. Reading also encompasses the learning of letters of the alphabet at one end of the reading spectrum and the learning and use of concepts and principles or rules at the other end.

Chunking is the processing of many bits of information and integrating them into a meaningful unit (Miller, 1956). Therefore, the goals of chunking are to achieve a reduction in quantity and to achieve a Gestalt or unity of information to facilitate learning. There is a restriction imposed, however, upon our ability to chunk information. At all stages of learning and particularly at the initial stages of chunking, the quantity of information cannot exceed or overload our short-term memory (STM) capacity, otherwise, a part of the information will be lost. This STM capacity, our ability to look at information briefly and to recall the information, is about seven for the average adult (Miller, 1956).

A distinctive feature is "discriminable element common to more than one and less than all of a set of configurations" (Smith, 1971, p. 120). As such, it is invariant from one instance to another, although it need not be exact (e. g., this letter a can be recognized as such even though it may vary from elite to pica type.

In reading, the distinctive features change depending upon the level of reading (Furukawa, Note 1). At the letter-learning level of reading development, distinctive features may be lines of various configurations which form letters of the alphabet through different spatial arrangements (e. g., c and l = d). Similarly, at the word stage, a distinctive feature may be individual letters, letter clusters, or whole words (e. g., s i n g i n g, sing ing, and singing, respectively). Except for these early stages of reading, or when a novel word is encountered, the reader is not normally concerned with these types of distinctive features. The reason is that the skilled reader reads for comprehension of ideas, not for identification of individual letters or words. As reading becomes more complex, so do the distinctive features. Specific examples will be presented later in conjunction with the findings at the various levels of reading.

From these definitions of skilled reading, chunking, and distinctive features, the discussion of the chunking method is based, namely, research findings in STM and learning. As for STM (also referred to as primary memory, immediate memory, memory span and attention span) it limits our ability to process information (Miller, 1956). For example, the limitation restructs the rate at which we read letters, words, and phrases (Smith, 1971). Consequently, high STM persons have been found to be better readers than low STM persons (e. g., Lyle & Goyen, 1968: Neville, 1968). Not only were the high STM persons better readers, but also they were better in learning simple three-letter words (Furukawa, Suydam, & Miller, 1969), a foreign language (Furukawa, 1970), and complex prose (Furukawa, 1972). Individual differences in STM, then, must be considered in any attempt to develop skilled reading.

As for learning research, there was some evidence to show that chunking distinctive features can ameliorate the adverse effects of STM limitations. As examples, it was found that subjects learned best when the quantity of information presented at one time before responses were required approximated the learner's STM score (Furukawa, 1970), and when chunking instructions were followed in learning three-letter words (Furukawa, Suydam, & Miller, 1969).

These findings recommended further consideration of the measurement of STM and of the application of the chunking strategy at all reading levels. These two topics will be considered next, in the order given.

Measurements of Short Term Memory

Two measures of memory span, for non-readers and readers at the elementary school level and at the college level, are discussed.

Elementary School

The test for non-readers is a visual STM (VSTM) and not an auditory STM test (Furukawa & Sunshine, Note 2). Also, the test does not use the traditional digits for three reasons: First, the ability to remember numbers differs from the ability to remember words (Crannell & Parrish, 1957; Wechsler, 1958); second, the primary medium of learning is verbal and not numerical; finally, the repetition of numbers across presentations may pose methodological problems (Keppel, 1965).

Development

Pictures of commonly observed objects were selected as test items, because the most basic level of verbal learning is labeling (Gagne, 1965) which may occur by age two (Jensen, 1966). Two equivalent or parallel forms of the test were developed: Forms Alpha and Beta, each consisted of a set of 5 practice or warmup slides followed by Parts One and Two each composed of 10 slides (See Table 1, for Test Alpha).

See Table 1

Testing

The slides were shown on a Singer Caramate for individual testing of non-reading children and on a slide projector for group testing of reading children. In both conditions, the slides were shown at the rate of one every 2 secs, with free recall periods following practice, Part One, and Part Two presentations. The recall test was oral for non-readers and written for readers.

Scoring was accomplished by giving one point for each correct response on Parts One and Two. The sum of the two scores was then divided by 2 to obtain a child's VSTM score.

Validity and Reliability

A preliminary assessment of the validity and reliability of the test was based on data collected at a school located in a large city. The median salary for the parents of the children at this school was $8,000. The STM means and standard deviations for 445 children, grades kindergarten through 6, are given in Table 2. The range of the means shows a low of 2.62 and a high of 6.27, with an

See Table 2

almost grade-by-grade increase. There was a significant correlation (.53) with age.

Before discussing validity, it should be noted that a principal components analysis of 26 different tests and subtests--only those which are pertinent to the discussions are identified--administered to 70 kindergarten children revealed three major components. One component was achievement or cognitive ability, consisting of a mass of 13 of the tests, with the highest factor loading among these being registered by the Lorge-Thorndike Cognitive Abilities Test and capital and small letter knowledge tests. A second component was VSTM and the third was auditory STM composed of a digit span test and an unrelated word test. Among all of these tests and subtests, the highest single factor loading of .83 was registered by the VSTM test of Furukawa and Sunshine.

In terms of criterion-related validity, the VSTM memory test was found to have a significant but low correlation (.39) with the knowledge of small letters by first graders. The correlation between the VSTM scores and the vocabulary scores on the Iowa Tests of Basic Skills was .50 and for reading on the same test was .43 for 229 children in grades 3 through 6. For this same sample, the Otis-Lennon Mental Ability Test (Verbal) correlated .50 with vocabulary and .44 with reading scores of the Iowa. Since the correlation between the Otis-Lennon and the VSTM test was low (.15), combining the two led to a better predictor of reading comprehension on the Iowa. The correlation was .57; thus, the two tests accounted for about 32 per cent of the total variance. Based on the principal components analysis, a combination of the Lorge-Thorndike.

small, or capital letter knowledge test, the Furukawa-Sunshine VSTM test, and the auditory STM test may provide a higher correlation with reading.

A parallel form reliability coefficient of .70 was obtained for 41 children who were randomly selected from grades K through 6. This correlation compared very favorably with the reliability coefficient of .56 reported by Lilly and Kelleher (1973) for a VSTM test administered to 8-12 year old children. Because of the very brief duration of the VSTM test (the total exposure time is 40 secs) very high correlations may be difficult to obtain. The reason for this is that the subjects are more likely to be affected by physical and psychological conditions, as well as environmental ones. Nevertheless, the reliability of the test can be improved by increasing the length of the test. One way of doing this is to administer two different forms of the test on separate days and to take average of the two as a measure of VSTM. This score indicates the approximate quantity of discrete units of information which the child can process at one time before rehearsals become necessary.

College

Development

Two forms of the college-level test have been developed: the first with a list of 20 two-digit numbers and a list of 20 adjective-noun pairs; the second with two lists of 20 adjective-noun pairs. In both cases, however, the test attempted to conform to Wickelgren's (1965) definition for STM. That is STM is being studied when items are presented once at a rate of less than 2 secs per item and retention is assessed after less than 30 secs.

Testing

Test items were presented at the rate of one every 2 secs, with a 2-minute free recall period. Scoring was accomplished by giving 1 point for each two-digit number and one for each adjective-noun pair correctly recalled. When only one word of an adjective-noun pair was correct, 1/2 point was given. The two scores were summed and divided by 2 to obtain a subject's VSTM score.

Validity and Reliability

Criterion-related validity was obtained from a number of different experiments. One of these showed a correlation of .56 between VSTM and performance in learning trigrams (Furukawa et al., 1969). Another experiment showed correlations varying from .30 to .81, depending upon the difficulty level of the task (Furukawa, 1970). The highest correlation was obtained with the most difficult task. The correlations, however, were probably somewhat inflated since an extreme-groups design, which excludes medium STM subjects, was employed.

Parallel form reliability for the test was .63 while a test-retest reliability of .77 was obtained.

Test Modification

The VSTM test was subsequently modified in two important respects: first by dropping the number list and replacing it with another word list (Table 3) and second by changing the method of presentation to a

See Table 3

simultaneous presentation of all words on a list for 1 minute, with a 2-minute

recall period after each list. The changes were dictated by a need to develop a test which more closely resembled what actually happens in a normal reading situation. The scoring remained the same as that for the earlier described test.

This 6-minute test showed substantial correlations (.40 to .53) with delayed posttest performance scores on four different learning modes (Furukawa, Young, & Sunshine, Note 3). On both immediate and delayed tests, the performances of the low VSTM subjects ($\bar{<}$6.75) were clearly surpassed by those of the high VSTM subjects ($\bar{>}$8.75). On a follow-up experiment, the correlation between VSTM performance scores on a programmed instruction learning mode for average STM subjects was about .44 on an immediate posttest and increased to.53 on a one-week delayed posttest. The VSTM and performance correlations appear to say that the test is really a long-term memory test instead of a short-term one.

When subjects were given two different forms of the test, a day apart, the correlation was a significant .47. Several explanatory comments are given: First, no attempt was made to develop parallel forms. The two tests used adjective-noun pairs which were randomly selected from a periodical. Second, the subjects tested were in a single class of educational psychology. Thus, they represented a restricted range of abilities. Third, the reliability of the test should be improved by averaging test scores over several administrations of the test.

The two tests of memory appear to show much promise and should be subjected to further evaluations, with the goal of adopting them for classroom use. Such an adoption will make it possible for teachers to gauge the quantity of information which is best for any given student.

From an exposition of VSTM tests, the discussion will now turn to the chunking of distinctive features.

Chunking of Distinctive Features

Four levels of reading/learning will be discussed, namely, letter, word, simple story, and complex prose.

Letter-learning Level

At this level, a distinctive feature may be lines of various configurations. For small letters, there are six features (See Figures 1 and 2): doughnut with a bite out of it or a dot, long and short sticks, and big and small hooks. For

See Figures 1 and 2

capital letters, there are four distinctive features: a long stick, short stick, a large C and a little c. Using these distinctive features, it is possible to form all letters (See Tables 4 and 5). As examples, a q can be formed by an

See Tables 4 and 5

arrangement of the doughnut and the long stick and Q can be a combination of the two large C's and the short stick. Note that the features themselves form

natural groups which reduce the number of elements to be remembered. Thus, in the case of the small letters, the number can be reduced to three groups: doughnut, stick, and hook. None of the letters requires the use of more than two different features, with the exception of capital R, which requires three: long stick, little c, and short stick.

In the learning of small letters of the alphabet, one group of first graders, randomly assigned to treatments after being ranked by VSTM scores, learned four letters, (g e m b) by manipulating the distinctive features to form the letters while another group of subjects used an operant technique (Furukawa, Note 1). Both groups learned the letters to the same level of proficiency, and then they were shown a second set of four letters (f a n d). Each letter of the second set was shown once, labeled twice, and then the subjects said the letter name twice. One rehearsal trial was given after a new learning trial (e. g., f was repeated after a). The distinctive feature chunking group was significantly superior to the operant group on pretest and delayed posttest gain scores (4.13 versus 2.50 letters. On the one-week delayed test, the chunking group was again superior, making only one-half the number of errors of the operant in recalling the eight letters (1.62 versus 3.38).

Word Level

In learning a new word, each of the individual letters of the word is initially a distinctive feature for the beginning reader and needs to be chunked. Later, letter, letter clusters, and even whole words begin to serve as distinctive features. As chunking examples, a first grader who first encounters the word someone may see it as s o m e o n e, a string of separate letters. Later, when he encounters it again, he may decipher the long word as so, me, one. Eventually, the word becomes someone, a single integrated unit instead of the original seven discrete letters.

A comparison of three methods of teaching reading and spelling (whole-word, discrete-letter, and chunking) by Furukawa and Sunshine (Note 4) found the chunking method to be clearly superior to the other methods, on training, transfer, and one-week delayed posttests (Table 6). The training and transfer words

See Table 6

had identical letter clusters in either clusters in either initial, internal, or end position (Table 7). Each of the 24 words are printed on three cards,

See Table 7

as follows (dashes indicate temporal and spatial separations and did not appear in print):

Whole-word. drip, drip, drip, with the entire word being pronounced for reading and pronounced and spelled for spelling.

Discrete letters. d-r-i-p, d-r-i-p, drip, with the word being phonetically pronounced with pauses in the first two cases and said normally in the last for the reading group subjects. In spelling, the word was pronounced normally before

each word was shown and spelled.

Chunking. dr-i-p, dr-ip, drip, with the word being phonetically pronounced in letter clusters and individual letters and normally pronounced when the whole word (last card) was presented. In spelling, the word was pronounced before the card was shown and spelled.

The transfer cards were printed exactly as were the whole-word cards. In other words, the entire word was either read or spelled normally for all subjects, irrespective of the earlier training.

The criterion test was the last card in the three-step series. For spelling, the word was said orally and a set of randomly arranged letters for the word was displayed. The subject was then required to rearrange the letters to spell the word, for example rdpi to form drip.

The total exposure time of a word was 12 secs per word on a learning trial. Up to five trials were allowed to achieve the criterion of one perfect repetition. And, after all six reading or spelling words were learned, a criterion of one perfect repetition was also required. At this point, additional learning trials were given when necessary.

The transfer task was administered one day after the training, with the delayed test administered six days after the transfer task.

As shown in Table 6, the chunking condition was superior on all tests. Across training and transfer conditions in spelling a word-length interaction effect was found, with the chunking condition subjects making fewer errors than those in the discrete-word condition on the longer words, but not on the shorter ones. Therefore, the findings appear to say that the more difficult a task (longer spelling words in this case), the more important the chunking strategy becomes.

Simple Story

The subject can be tentatively identified as one of the distinctive features of sentences. This decision is supported by a finding by Horowitz and Prytulak (1969) that the subject of the sentence had the redintegrative power or cue value in recall. The four reasons which they gave for selecting the subject were: (a) it is more concrete; (b) it is the larger part of the contextual whole; (c) it has a greater number of associations to facilitate recall; (d) it is normally the first in the sequence of a sentence. To these four reasons, a fifth can be added: The subject meets the definition of a distinctive feature in that it helps to make one sentence different from another.

In a simple story, the title of the story, the subject of each paragraph, and the subject or predicate of each sentence may be the distinctive features which can be organized to facilitate chunking. An example of such a structure is shown in Table 8.

See Table 8

In the learning of two stories, such as the one shown in Table 10, three different reading modes were used (Note 1). One group of second and third grade subjects,

assigned by block randomization after being ranked by VSTM, learned the stories without either paragraph headings or summary last sentences. A second group learned the stories exactly as given in the example in Table 10. A third group learned the same materials as the second group, but with pictures that chunked the information across paragraphs for an entire story. To illustrate, there was a picture of a red school on the right border of the first paragraph, a picture of the red school and teacher for the second, and of a red school, teacher, and bus for the last paragraph. This reading mode, then, provided maximum chunking assistance. Consequently, the children learned best by this mode as indicated by performances on a two-week delayed posttest (means of 5.19, 5.69, and 7.25, respectively for the three conditions). The chunking strategy apparently aided in reducing the quantity of distinctive features to 2 for the picture group compared to 18 for the non-chunking-assistance group.

Complex Prose

The identification of distinctive features at the complex prose level is somewhat complicated. Therefore, additional elaboration is needed.

To supplement Smith's (1971) and Horowitz's and Prytulak (1969) statements, Furukawa (1972) concluded that the response chunks (designated nouns or adjective-nouns) were the critical features in the programmed instruction frames (paragraphs). The number of chunks needed in responding correctly to completion questions was found earlier to be important, while the physical length of the paragraph was not, in determining the difficulty level of the text material in relation to the subject's VSTM capacity (1970). If the units of information were identified and highlighted by questions and answers, superior recall of these units resulted (Furukawa, 1972). Finally, the features should be able to subsume or unite lower units of information, as is true in the case of section headings (Furukawa, Notes 5 and 6).

Combining the definition of Smith and the findings of Horowitz and Prytulak and of Furukawa, it may be possible to operationally define a "distinctive feature" in prose material. A distinctive feature in prose material is a word or a group of words meeting three criteria: (a) differentiation in that it makes one sentence, paragraph, or story differ from another; (b) identification in that it is highlighted, emphasized, or identifiable in some way; (c) requirement in that it is necessary to respond to a test question. Normally, the distinctive feature should be a noun or adjective-noun combination which is the subject of the sentence, paragraph, or story. However, when the subject remains the same from one sentence to the next, the key words in the predicate may be the distinctive feature. In either case, it should be capable of subsuming lower order units of information.

A distinctive feature, then, must meet at least three criteria: differentiation, identification, and requirement. Ideally, the distinctive feature should be able to function as a nexus capable of subsuming lower order facts, concepts, or the lower forms of learning (cf., Ausubel, 1968; Gagne, 1965). The selection of the nexus depends upon three factors: one, the VSTM score of the learner; two, the organization of the text; three, the stage of reading or learning (e. g., Craik & Lockhart, 1972). To illustrate the application of the first two factors, a learner with a VSTM score of three should try to select a word

that can tie together three distinctive features in a meaningful way. Thus in reading the simple story about school (See Table 8), the learner should do the following: read the first paragraph, stop, and rehearse by associating the three distinctive features of the three sentences (my school, big, and red) with the nexus word "school." As the story is given, of course, the chunking is accomplished for the reader by the addition of a fourth sentence. The same reading steps are taken with the distinctive features under "teacher" and "bus". In later practice, the third factor is applied. That is, these nexuses are, in turn, chunked under the word "school", the title of the entire story. In essence, the word selected to be the nexus should help to tie together appropriate quantities of lower order facts, concepts, and principles or rules.

A study compared the effectiveness of four learning modes (text only, chunking study outline, programmed instruction, and adjunct questions) used by college students with high, medium, and low VSTM (Furukawa, Young and Sunshine, Note 3). The text only control condition presented a periodical article without modification. The chunking study outline condition provided an outline of the distinctive features (See Table 9 for a sample chunking study outline). The

See Table 9

programmed instruction condition, devised for average VSTM subjects by interspersing seven sets of seven questions and answers throughout the article, asked questions to elicit the distinctive features given in the chunking study outline. The adjunct question condition used questions which were like those used in the programmed instruction condition except that they were not completion-type questions (fill in the blank) but short-answer questions. Of these learning modes, only the programmed instruction mode was found to be significantly better to the text-only mode although the means of all modes were higher than that of the control. A marginal interaction plus the highest VSTM and delayed posttest performance correlation (.53) suggested that the programmed instruction mode was not the best for the low VSTM students. The fact that all correlations between VSTM and performances were significant and increased from the immediate to the delayed posttest except for the chunking study outline mode suggested that the chunking strategy may be beneficial in reducing the limitation imposed upon learning by VSTM.

A subsequent experiment combined the programmed instruction and chunking study outline learning modes into a chunking programmed instruction (CPI) mode and compared it against text only and programmed instruction (Furukawa, Note 7). This new learning mode required the high, medium, and low VSTM subjects to outline their answers under section headings as they worked through the program and to use a chunking study outline in rehearsals. Before taking any of these steps, however, the subjects were asked to read twice the title of the article and all seven major section headings.

The results of the immediate and delayed posttests showed the CPI mode to be best and the high VSTM subjects to be superior to the low. Despite having had inferior posttest scores, the low VSTM subjects benefitted most from the CPI. Also, the correlations between VSTM and CPI scores showed a downward trend from immediate to delayed posttests while the correlation increased significantly for programmed instructions. Therefore, the CPI appeared to be a viable means of providing instructions, especially to low VSTM subjects.

For the low VSTM subjects, performance on posttests probably can be improved by either presenting a smaller quantity of information at one time before requiring responses or by increasing study time; doing both may be best.

Discussion

From an initial presentation of definitions, an attempt was made to present some evidence to show that the strategy of chunking distinctive features can lead to skilled reading. The evidence encompassed different levels of reading, from letters of the alphabet, words, simple stories, to complex prose. At all levels of reading, chunking appeared to be effective.

The implications for classroom practice are many, but all are based on a chunking strategy. Such a strategy depends upon a knowledge of the VSTM capacity of every child, the distinctive features, and the chunking process. In terms of VSTM, the teacher, while keeping in mind that there is a constant increase in capacity over the years, can use this measure as a gauge of the approximate quantity of distinctive features which should be read before rehearsals become necessary; otherwise, overloading and a loss of information occurs. Because of this quantity limitation, the greater the variability of the memory spans of the children in a given class, the more difficult the teaching becomes. If the teacher gears his instructions to the average VSTM child, then the low VSTM child will be lost while the high VSTM child will be bored by the lack of a challenge.

There is a need to individualize instruction or to group children according to VSTM capacities. The latter will permit a teacher to match the quantity of distinctive features provided to the STM capacity of the children.

Such an instructional methodology emphasizes the importance of knowing what distinctive features are. At each level, the distinctive feature changes, but they should meet at least the criteria of differentiation, identification, and requirement. A fourth criterion may be that they should be capable of acting as nexuses to tie together suitable quantities of lower order information into a meaningful whole. As such, the selection of nexus may well depend upon the VSTM capacity of the learner, the organization of the material, and the stage of reading or learning.

Through the chunking process, then, quantities of distinctive features which approximates the VSTM capacity of the reader are grouped or united in a hierarchical structure, so that countless subordinate units can be formed into one meaningful whole. Thus, the information can be most efficiently stored for rapid and accurate recall for use at a later date.

To prevent possible misinterpretations and misuses of the chunking method, the following caveats are given: a) the procedure is to work at the child's level of processing and not to regress the child, b) the processing of information should always be at the highest level possible, c) the goal is to take the child to the next higher level from the present level. These abstractions can be illustrated at a concrete level: assuming that we are at the kindergarten level, we find a few children who do not know any of the letters of the alphabet, a few who do know some of the letters, and a few who are already reading. Taking the middle group, it would probably be a waste of their time to teach them distinctive features of the alphabet unless they have difficulties in distinguishing certain ones, e.g., w from m. As soon as sufficient letters are learned, these should be

used in a written word. And, as soon as a word is learned, it should be used in a spoken sentence, with the ultimate goal of having written sentences. These sentences should be related ones, capable of being united into a meaningful paragraph.

Because of the importance of these caveats, another example is provided. In teaching letters, the features should not be used to teach all letters, but only the first one which requires a feature (t, h, i, e, f for small letters T, Q, B for capital letters). Likewise, once the child shows that he realizes that drip and drug both have the dr letter cluster which can be treated as one single unit, the spatial and temporal separations should be omitted. In short, the aim is to get the child ready to automatically chunk when reading normally printed text.

Since the chunking of letters and letter clusters may lead to a commonly employed but potentially damaging step, another caveat is given. That is, because learning the word drip through a chunking strategy facilitates the learning of drug, this fact may lead a teacher to present a whole list of words beginning with dr, such as drum, drop, drab, and so on. The expectation is that these words will be learned quickly, too. The opposite effect could occur. There could be an interference effect, because of the similarity of the words.

Much additional research remains to be done. For example, how can chunking be employed in the teaching of meaning of words and of concepts in particular. Nevertheless, with the knowledge available, much can be done with the chunking of distinctive features as a means of developing skilled reading. In fact, at the university level, the passing rate (C or higher) of low SAT students has been successfully increased from 38% to an average of 90% by using the chunking strategy (Furukawa, Cohen, Sumpter, and Hirsh, Note 8).

References

Ausubel, D.P. The use of advance organizers in the learning and retention of meaningful verbal material. Journal of Educaticnal Psychology, 1960, 51, 267-272.

Craik, F.I.M. & Lockhart, R.S. Levels of processing: A framework for memory research. Journal of Verbal Learning and Verbal Behavior, 1972, 11, 671-684.

Crannel, C.W. & Parrish, J.M. A comparison of immediate memory span for digits, letters, and words. The Journal of Psychology, 1957, 44, 319-327.

Furukawa, J.M. Chunking method of determining size of step in programmed instruction. Journal of Educational Psychology, 1970, 61, 347-354.

Furukawa, J.M. The critical chunk, physical length, and number of words per chunk in programmed instruction. Journal of Educational Research, 1972, 65, 361-364.

Furukawa, J.M., Suydam, M.M. and Miller, S. The effects of grouping instructions in short-term memory. Psychonomic Science, 1969, 15, 81-82.

Gagne, R.M. Conditions of Learning. New York: Holt, Rinehart & Winston, 1965.

Horowitz, L.M. & Prytulak, L.S. Redintegrative memory. Psychological Review, 1969, 76, 519-531.

Jensen, A.R. Individual differences in concept learning. In J.J. Klausmeier and W. Harris (eds.), Analyses of concept learning. New York: Academic Press, 1966.

Keppel, G. Problems of method in the study of short-term memory. Psychological Bulletin, 1965, 63, 1-13.

Lilly, S.m., & Kelleher, J. Modality strengths and aptitude-treatment interaction. The Journal of Special Education, 1973, 7, 5-13.

Lyle, G.G. & Goyen, J. Visual recognition, developmental lag, and strephosymbolia in reading retardation. Journal of Abnormal Psychology, 1968, 73, 25-29.

Miller, G. A. The magical number seven, plus or minus two: Some limits on our capacity for processing information. Psychological Review, 1956, 63, 81-87.

Neville, M.J. Effect of reading method on the development of auditory memory span. The Reading Teacher, 1968, 22, 30-35.

Smith, F. Understanding reading. New York: Holt, Rinehart, & Winston, 1971.

Wechsler, P. The measurement and appraisal of adult intelligence. (4th ed.). Baltimore, Maryland: William & Wilkins, 1958.

Wickelgren, W.A. Acoustic similarity and retroactive interference in short-term memory. Journal of Verbal Learning and Verbal Behavior, 1964, 4, 53-61.

Reference Notes

1. Furukawa, J.M. Skilled reading through the measurement and amelioration of the effects of visual short-term memory. Paper presented at the Ninth Annual Gatlinburg Conference on Research in Mental Retardation, Gatlinburg, Tennessee, March, 1976.

2. Furukawa, J.M. & Sunshine, P.M. Visual short-term memory test for non-readers and readers. Paper presented as a part of the Innovator's Exchange Program of Division 16 (School Psychology), American Psychological Association Convention, San Francisco, August, 1977.

3. Furukawa, J.M., Young, P.M., & Sunshine, P.M. Short-term memory effects in four learning modes. Paper read at the meeting of the American Psychological Association, September, 1975.

4. Furukawa, J.M. & Sunshine, P.M. Chunking effects in reading and spelling. Paper presented at a meeting of the International Reading Association, Miami Beach, May, 1977.

5. Furukawa, J.M. A psychologist's formula for college success. Towson State University Foundation, Towson, Maryland, 1971.

6. Furukawa, J.M. The successful student. Towson State University, Towson Maryland, 1976.

7. Furukawa, J.M. Learning mode and short-term memory effects in learning. Paper presented at the meeting of the American Psychological Association, San Francisco, August, 1977.

8. Furukawa, J.M. Cohen, N., Sumpter, K., Hirsh, A. Instructional innovation: chunking method of teaching and studying. Paper presented at the meeting of the American Psychological Association, San Francisco, August, 1977.

Table 1

Visual Short-Term Memory Item List (Form Alpha)

Practice		
rifle		
hat		
bird		
watch		
lamp		
Part One	**Part Two**	
bed	television	
flowers	tree	
toothbrush	comb	
bat	football	
spoon	fork	
lion	dog	
truck	bus	
ship	helicopter	
policeman	doctor	
key	ladder	

Table 2

Visual Short-Term Memory Test Means and Standard Deviations (K-6)

Grades	Means	Standard Deviations	Number
K	3.62	.87	70
1	2.62	2.02	43
2	4.58	1.16	77
3	5.18	1.32	42
4	4.93	1.14	88
5	6.27	1.36	85
6	6.21	1.37	40

Table 3

Visual Short-Term Memory Test (College Level)

List One

fresh strawberries	solar gases
moving moment	health foods
automated system	college teaching
safety rule	all cars
equipped laboratories	entire family
good taste	each letter
farm clothes	sharper picture
underprivileged children	predominant group
loving care	moon's surface
church bazaar	ancient art

List Two

American colonies	smaller colonies
fertile lands	largest items
small part	king's power
foreign trade	peaceful conditions
raw materials	expert navigators
postal service	fierce people
every tree	growing season
another adventure	large map
native civilization	early efforts
historic voyage	world leadership

Table 4

Small Letters Categorized by Distinctive Features

Distinctive Features	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
doughnut:	x	x	x	x	x		x								x	x	x		x							
long stick:		x		x				x			x		x				x	x			x					x
short stick:	x				x	x			x			x		x					x		x	x	x	x	x	x
big hook:						x	x			x																
small hook:								x					x	x					x							
spot:									x	x																

Table 5

Capital Letters Categorized by Distinctive Features

Distinctive Features	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
long stick:	X	X		X	X	X		X	X		X	X	X	X		X		X		X	X	X	X	X		X
short stick:	X			X	X	X	X	X	X	X	X	X					X	X		X	X		X		X	X
large C:			X	X			X								X		X									
small c:		X								X						X			X	X						

Table 6

Mean Number of Errors on Training and Transfer Tasks and Delayed Posttest

	Treatments[a]					
	Whole-word		Discrete-letter		Chunking	
Tests	R[b]	S[c]	R	S	R	S
Training[d]	4.22	9.89	4.11	14.11	1.22	6.00
Transfer	3.44	6.22	3.67	5.78	1.33	2.67
Delayed[e]	9.33	7.56	8.89	7.22	5.78	5.11

[a] n = 9 per group [b] R (Reading) [c] S (Spelling) [d] Training errors possible=30

[e] Delayed errors possible=12

Table 7

Word Lists

Training	Transfer
drip	drug
field	brief
reading	singing
space	speak
toad	goat
coldest	longest
slow	slid
feel	seen
sailed	talked
track	trade
pain	wait
nicely	weakly

Note: Letter clusters to be generalized are identified by underlining.

Table 8

Story

School

School
That is my school.
It is big.
It is red.
My school is big and red.

Teacher
That is my teacher.
He is tall.
He is a man.
My teacher is a tall man.

Bus
That is my bus.
It is long.
It is yellow.
My bus is long and yellow.

Table 9

Chunking Study Outline

Chapter 6. Thinking (p. 204)

I. The Units of Thought
  A. Building blocks
    1. images
    2. concepts
    3. language
  B. Images
    1. synesthesia
    2. metaphor
    3. eidetic
  C. Concepts
    1. conjunctive
    2. disjunctive
    3. dimensional
    4. explanatory
    5. singular
  D. Language
    1. linguistic relativity
    2. psycholinguists
    3. phoneme
    4. morpheme
    5. syntax
    6. semantics

II. Directed Thinking
  (omitted)

Figure Caption

Figure 1. Distinctive Features of Small Letters

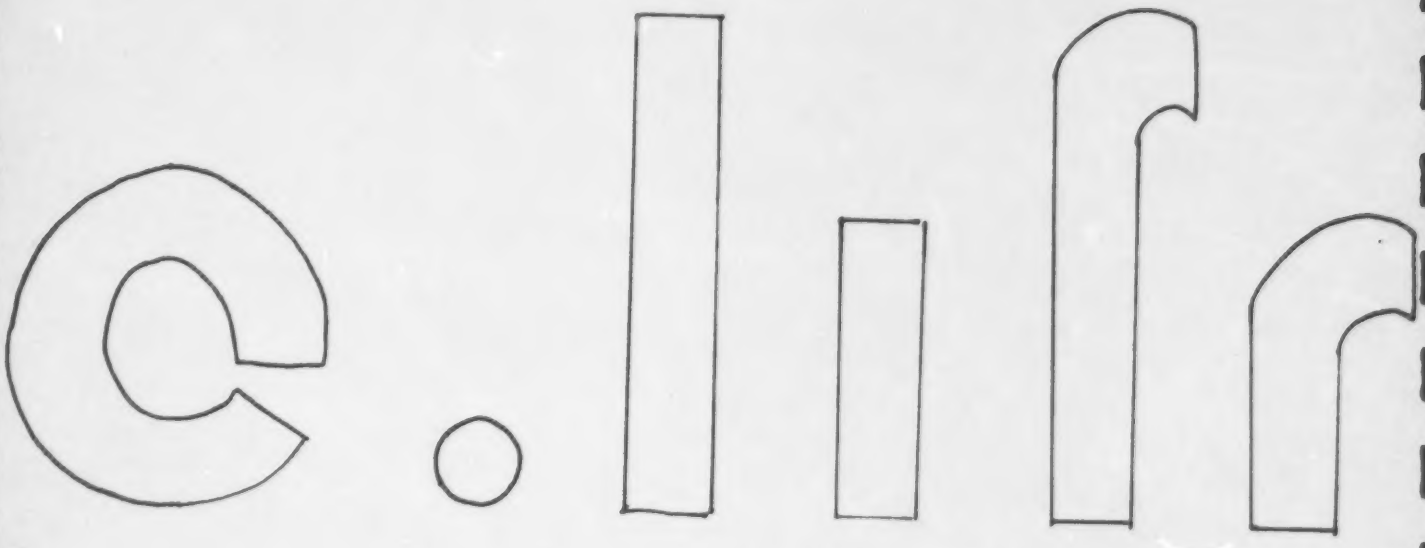
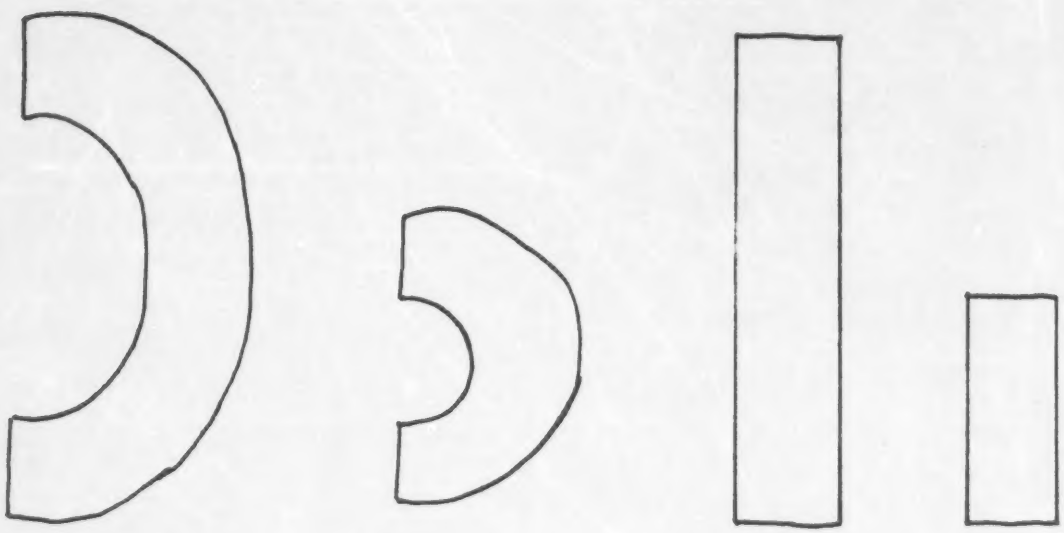


Figure Caption

Figure 2. Distinctive Features of Capital Letters



EFFECT OF STIMULUS CONTEXT ON NOVEL RESPONDING

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Abstract

Eighty-two elementary school students in the third, fourth, fifth and sixth grade were administered Torrance's Circles Test (CT) and a closed figures test consisting of random figures (RFT). A higher overall response was found on the CT, but the proportion of creative responses produced did not distinguish the groups. The correlation between "creative" (novel-response) performance CT and RFT was .48, suggesting that the two tests focus on somewhat different aspects of creative performance. It is suggested that tests which use uncommon geometric forms may be a useful addition to creative assessment batteries.

The intent of many creativity measures is to distinguish between divergent and convergent thinking (e.g., Getzels and Jackson, 1961; Guilford, 1962; Torrance, 1962). Such a distinction, however, has been difficult to demonstrate empirically (e.g., Thorndike, 1965; Ward, 1966). A potentially more useful distinction in investigations of creativity is the distinction between productive and reproductive thinking (Birch and Rabinowitz, 1950; Fowler, Jans, and Funderburk, 1975). Despite the relevance of such a distinction to many current accounts of creativity, assessment of creative behavior still seems to rely primarily on reproductive thinking. Thus, much of what is assessed as "divergent" creative ability could be seen as an assessment of responses cued specifically by some referent in the environment.

For example, a test such as Torrance's Circles Test (CT), which purports to measure divergent thinking, seems to involve a strong "reproductive thinking" component (Fowler et. al., 1975). If the circles serve as cues to reference points in the environment, the validity of the measure (as an assessment of "creativity") could be reduced. At the extreme, the test could function simply as a measure of recall of previous experience with similar stimulus objects. In their discussion of this issue, Fowler et. al. argues that a test measuring productive creativity must fulfill two criteria: 1) the task must require restructuring and repatterning of one or more stimuli in accordance with task demands, and 2) test stimuli are required which would be unlikely to have been prominent reference points in the environment. A test meeting such criteria would seem to minimize the effects of previous experience with items similar to those used in the assessment device. A measure developed by the authors, RFT - Random Figures Test, based on complex random figures described at Attneave (Attneave, 1957; Attneave and Arnoult, 1956) meets these criteria. If this measure assesses a different dimension of creative performance, it would allow a greater correspondence between current theoretical formulation of creativity and the operations by which those formulations are measured.

The present report describes a preliminary comparison between performance on the CT and two forms of the RFT in elementary school students.

Method

Subjects

Eighty-two students attending the third, fourth, fifth and sixth grade at the Lida Lee Tall Learning Resources Center, Towson, served as subjects.

Materials

Three mimeographed forms, each using a different stimulus figure, were used. Each form consisted of a page of 12 repeated closed stimulus figures approximately 38.1 mn in diameter. As illustrated in Figure 1, one form was an adaption of Torrance's Circles Test (CT) (1968). The second and third forms (RFT-1; RFT-2) contained random figures generated by the methods described by Attneave and Arnoult (1956).

See Figure 1.

Procedure

Subjects were administered both tests on the same day. In the third and fourth grades, the CT and RFT-1 were administered with order of test administration counterbalanced. In the fifth and sixth grades, the tests were given as part of another experimental procedure and order of administration was not controlled (RFT-2 was given first, followed by CT).

Subjects were tested as groups in their respective classrooms. After the appropriate test form was distributed, the following instructions (Torrance, 1962) were read:

> "In 10 minutes see how many objects you can make from the figures on the page in front of you. The figure should be a main part of whatever you make. With pencil or crayon add lines to the figures to complete your picture. Your lines may be inside the figure, outside the figure, or both inside and outside the figure. Try to think of things that no one else will think of. Make as many things as you can and put as many ideas as you can in each one. Add labels or titles if the identity of the object is not clear. Are there any questions?"

All questions were answered completely. Children were then instructed to put their names on their paper. The children were told that they would have ten minutes and that they could use as many pages of the form as they needed. The children were then told to begin. At the end of ten minutes, the children were told to stop, and asked to be sure to label any pictures that might not be clear. The first form was collected and the second form distributed. The same instructions were read and the same procedure followed for each form.

For purposes of scoring, eight dimensions of response were distinguished: novelty, stereotypy, simplicity, elaboration, novel-elaborate, stereotyped-elaborate, novel-simple, and stereotyped-simple. Novelty vs. stereotypy and elaboration vs. simplicity were considered the basic response dimensions. The remainder of the scales consisted of response classifications based on combinations of the basic dimensions. Scoring criteria are outlined in Table 1.

See Table 1.

Results

Interscorer agreement with respect to the response classifications ranged from .90 to .95 with a mean interscorer agreement of .92. The Pearson product moment correlation between novelty and novel-elaborate scores assigned by the two primary scorers exceeded .95.

Analysis of the between-test correlations for the basic response dimensions, which indicates the extent to which the tests can be considered to be assessing the same dimensions, found statistically reliable correlations between novel responding ($r = .48$, $df = 80$, $p < .001$), stereotypic responding ($r = .50$, $df = 80$, $p < .001$) and form elaboration ($r = .40$, $df = 80$, $p < .001$). While statistically reliable, these correlations suggest that the two tests are measuring different (though overlapping) dimensions.

Further analysis of differences between the tests in characteristics of responding was carried out by means of a multiple regression analysis using the response-dimension scores as independent variables and test (CT vs. RFT-1 or RFT-2) as the dependent measure. This analysis is formally equivalent to a discriminant analysis (Kerlinger and Pedhazur, 1973), and identified the response dimensions which best distinguish the two tests.

This analysis revealed the CT performance was characterized by a higher rate of novel responses ($F = 29.16$, $df = 1,83$, $p < .001$) and a higher rate of simple responses ($F = 7.24$, $df = 1,82$, $p < .01$).

Overall, performance on the CT was characterized by a higher response rate on nearly all dimensions. Comparisons between the two tests on the eight response dimensions for four groups of subjects (third and fourth grade, order 1; third and fourth grade, order 2; fifth grade; sixth grade) found CT dimension scores higher in 29 of the 32 comparisons ($z = 4.42$, binomial test with correction for continuity, p .00003). However, an analysis in terms of the proportion of test responses which could be considered "creative" (i.e., novel or novel-elaborate) failed to reveal any differences between the tests. Thus, although subjects produced a higher overall rate on the CT, no differences between the tests were found in the proportion of responses which could be considered "creative."

Discussion

The present results support the interpretation of performance on the CT proposed by Fowler et. al. (1975). Because the circle is a more common form in the environment than the random figures used in our investigation, a higher overall response rate was generated on the CT. The proportion of "creative" responses, however, did not distinguish the two tests. It is interesting to note that the subjects identified as "creative" on one test would not necessarily be those identified as "creative" on the other. The correlation between novel responding on the two tests was only .48, a relation which accounts for only 23% of the variance. It seems likely that the CT taps "reproductive" thinking to a greater extent than the RFT. Although the present findings are regarded as preliminary, they do suggest that the distinction between productive-reproductive thinking is a useful one which could aid in the identification of "creative" students in a classroom situation. In this regard, measures such as

those described in this report could be a useful addition to current creative-behavior assessment techniques.

References

Attneave, F. Physical determinants of the judged complexity of shapes. Journal of Experimental Psychology, 1957, 53 (4), 221-227.

Attneave, F. & Arnoult, M. The quantitative study of shape and pattern perception. Psychological Bulletin, 1956, 53, 452-471.

Birch, H. & Rabinowitz, H. The effect of previous experiences on productive thinking. Journal of Experimental Psychology, 1951, 41, 121-125.

Fowler, M.J., Jans, J.E., and Funderburk, F.R. An operational procedure for novel response enhancement. Paper in preparation for ERIC files.

Getzels, J.W. & Jackson, P.W. Creativity and intelligence. New York: Wiley, 1961.

Guilford, J.P. Creativity: Its measurement and development. In S. Parnes and H. Harding (eds.), A source book for creative thinking. New York: Scribner, 1962, 151-168.

Kerlinger, F.N. & Penhazur, E.J. Multiple-regression in behavioral research. New York: Holt, Rinehart and Winston, 1973.

Thorndike, R.L. The measurement of creativity. Teachers College Record, 1963, 64, 422-424.

Torrance, P.E. Guiding creative talent. Englewood Cliffs: Prentice-Hall, 1962.

Ward, W.C. Creativity and impulsivity in kindergarten children. Doctoral dissertation. Duke University, Durham, N.C., 1966.

TABLE 1

SCORING CRITERION FOR EIGHT DIMENSIONS

OF RESPONSE

TYPE OF RESPONSE	RESPONSE CRITERION			
	CONSTRUCTION WHICH HAD NOT PREVIOUSLY OCCURRED	CONSTRUCTION WHICH WAS DUPLICATED DURING A GIVEN SESSION	CONSTRUCTION WHICH CONTAINED FOUR CLEARLY DISCERNIBLE FEATURES	CONSTRUCTION WHICH CONTAINED LESS THAN FOUR CLEARLY DISCERNIBLE FEATURES
NOVEL	*			
STEREOTYPY		*		
ELABORATION			*	
SIMPLICITY				*
NOVEL-ELABORATE	*		*	
NOVEL-SIMPLE	*			*
STEREOTYPED-ELABORATE		*	*	
STEREOTYPED-SIMPLE		*		*

Figure Captions

Figure 1: Examples of stimulus figures from each test form.

FORM A FORM B FORM C

ANECDOTAL GROUP GUIDANCE WITH A FIFTH GRADE CLASS: EXPERIMENT I

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The use of stories and discussion as a group guidance activity dates back to the 1930's (Jones, 1931). Until recently, little research has been conducted to determine the efficacy of this technique in the elementary school. Within the last decade, several experimenters have attempted to evaluate the effectiveness of the story-discussion approach in helping elementary school children to make a better personal and social adjustment (Anderson & Schmidt, 1967; Bedrosia, Sara, & Pearlman, 1970; McBrien & Nelson, 1972). However, as Howard and Zimpfer's (1972) review of the literature on group approaches indicates, there is still a paucity of research in this area.

The conflicting results of previous studies utilizing group guidance stories suggests that there are a number of problems which must be resolved. Of particular concern is the selection of evaluative instruments to assess whether the stories have been effective in helping children to learn the appropriate behaviors for dealing with the specific social situations that they encounter. So far, the measures which have been employed have failed to achieve this objective. Thus, it is difficult to determine how much the story-discussion approach has contributed to the improved personal and social adjustment of many youngsters.

Purpose of the Study

The purpose of this study was to determine whether an anecdotal group guidance program, which was developed by the investigator (Lavin, 1973), was effective in improving the social adjustment of fifth grade pupils at a local elementary school. The anecdotes that were used consisted of a series of short stories about boys and girls who engaged in behavior which was aversive to those persons with whom they interacted. In order to assess the program's effectiveness, equivalent forms of the Lavin Scale of Social Adjustment were used as the pre- and posttests. Since this instrument attempts to determine how pupils would behave in situations similar to those put forth in the anecdotes, it was considered to be appropriate for assessing the children's improvement.

Subjects

Twelve boys and nine girls, the entire fifth grade class at one of the local elementary schools, served as the subjects. These youngsters were selected because the teacher expressed an interest in using the anecdotal approach to improve their social skills. Although there were twenty-one children who participated in the experiment, pre and post-gain scores were computed for only nineteen subjects because two were absent during the initial phase of the study.

Instrumentation

Forms A and B of the Lavin Scale of Social Adjustment, an instrument which was developed by the investigator, was used to assess the effectiveness of the anecdotal group guidance approach. Although the original Scale contained twenty items, for

the purposes of this study, the number was increased to twenty-five.

In each of the items, a hypothetical main character with a particular problem was presented. The subjects were then asked what the main character should do to resolve the difficulty confronting him. This approach was used because it was felt that it would be less threatening than directly asking the children to indicate how they would deal with that situation. However, it was assumed that they were actually putting themselves in the place of the main character and that the solutions that they proposed for him were the solutions that they would also propose for themselves. Sample items from the Scale are as follows:

Form A

1. It was almost time to leave the school. Sam was working on a model that he wanted to finish before the end of the day. He needed to use the glue that Mr. Smith had bought for the class. Tim was using the glue, however. When Sam asked Tim if he could use the glue, Tim said that he had not finished with it yet. What should Sam do about getting the glue? (Lavin, 1973, p. 95)

Form B

1. Tom was in a hurry to finish the drawing on which he was working. He needed to use the new crayons that Mr. Lester had bought for the class. The crayons were lying on Bill's desk. When Tom asked Bill for the crayons, Bill said that he hadn't finished using them yet. What should Tom do about getting the crayons? (Lavin, 1973, p. 105)

The answers that were given by the subjects were scored according to a 2, 1, 0 scheme. A score of 2 was given when it was indicated that the main character should engage in a positive social behavior in solving the problem. A positive social behavior would be one indicating responsibility, sympathy, politenss, honesty, and so forth. One point was given for an answer which was not considered to be the most appropriate way to solve the problem or for an answer which was not complete. Zero points were given when the subject indicated that the main character should engage in a negative social behavior such as lying, cheating, stealing, and so forth. Scoring guides for each of the preceding sample items are as follows:

Form A Answer Scoring Guide Item 1

2 points --- Sam should ask Tim if he could use the glue when he finishes with it. Sam should ask Tim if he could share the glue with him.

1 point --- Sam should wait for Tim to finish using the glue.
Sam should go back to his seat and work on the parts of the model that don't need glue.

0 points --- Sam should demand that Time let him use the glue.
Sam should take the glue from Tim. (Lavin, 1973, p. 95)

Form B Answer Scoring Guide Item 1

2 points --- Tom should ask Bill to let him use the crayons when he finishes with them. Tom should ask Bill if he could share the crayons with him.

1 point --- Tom should wait for Bill to finish using the crayons. Tom should go back to his seat and work on the parts of the drawings which he doesn't have to color.

0 points --- Tom should demand that Bill let him use the crayons. Tom should take the crayons. (Lavin, 1973, p. 105)

Treatment

The children in this experiment participated in twelve, forty-five minute anecdotal group guidance sessions over a three week period. The investigator served as the group leader while the teacher observed and occasionally participated in the application of the technique.

At the beginning of each session, one anecdote about a boy or girl with a particular behavior problem was presented to the group for discussion. In each of the anecdotes, emphasis was placed on specifically describing the main character's behavior, the reactions of other persons to him, and the coping mechanisms that he used to deal with anxiety, frustration, and guilt. A sample anecdote that was used during the treatment is as follows:

> The girls all gathered into a group during recess. They had just completed work on a geography test, and they were discussing the answers to some of the questions. The test had been a difficult one, and everyone was quite anxious about the results. Just after the discussion got underway, Bonnie came up and joined the group. When she approached, the girls stopped talking and for a few seconds, there was silence.
>
> Bonnie was a good student, and she usually did well on Mrs. Browning's exams. The problem was that after every test she would always tell everyone how easy it was, and how well she had done on previous examinations. Today was no exception. As soon as she entered the group, Bonnie began talking about how she answered the various questions and mentioned that she had gotten two A's on Mrs. Browning's last two tests. Bonnie continued by stating that she thought that school was just too easy, and that she wished that Mrs. Browning would make things harder for her since she always seemed to make the highest grades in the class.
>
> The other girls shifted their feet back and forth while Bonnie was talking. A few of them looked at each other and snickered, and some left the group and walked toward the back of the school. As soon as Bonnie finished, the rest of the girls walked off to different parts of the playground, and Bonnie was left standing by herself.
>
> As the girls wandered away, Bonnie looked at them. A scowl was on her face. She couldn't understand why the girls had walked off like that. Probably they're just jealous because I can do so much better than they can," she thought. "Oh well, I don't need them anyway, she said to herself. "When they find out how well I've done on the geography test, they'll be sorry they didn't pay more attention to what I was talking about." (Lavin, 1973, Pp. 35-36)

When the presentation was completed, questions were asked about the causes of the main character's behavior, the effect that his behavior had on other persons, the defenses that he used, and the kinds of behavior that he might engage in to help him to resolve his difficulties. Role playing activities in which the subjects demonstrated the main character's aversive behavior and behavior which would be more appropriate for dealing with the various problem situations were also used. Throughout the course of the study, it was hoped that the anecdotal approach would serve as a catalyst for helping the children to understand their feelings and their attitudes and that it would help them to learn viable behavioral strategies for coping with social situations confronting them in their own lives.

Results

Pre and post-gain scores for each subject and a pre and post-mean score for the group showed an improvement in social adjustment according to the Lavin Scale. A further analysis of the data showed that ten subjects gained between 1 and 16 points, two children scored the same, and seven subjects lost between 1 and 4 points.

The approach appeared to be particularly effective with those youngsters whose pre-test scores fell in the lower half of the class. As Table II shows, six of these children improved their scores on the Scale with five subjects gaining between 12 and 16 points.

TABLE I

Difference between Pre- and Post-group means

Pre-mean	Post-mean	Difference
24.57	28-10	+ 3.53

TABLE II

Difference between Pre- and Post scores for subjects below the Median

Subject	Pre-score	Post-score	Difference
A	25	30	+ 5
B	22	19	- 3
C	21	33	+12
D	19	17	- 2
E	19	32	+13
F	18	34	+16
G	18	17	- 1
H	16	28	+12
I	15	27	+12

Discussion

This study shows that anecdotal group guidance can be effective in helping youngsters to learn the appropriate behaviors for dealing with various social situations. As the results indicate, this technique appears to be particularly effective with children who exhibit a deficiency of social skills. While conducting the sessions, it was evident to the investigator and the classroom teacher that many of these children were unaware of those behaviors which would help them to function more effectively with their peers. The use of the anecdotes coupled with role playing activities and discussion appeared to be of much value in assisting them to develop more viable social behavior.

One last point is worthy of note. The anecdotal approach seemed to serve as a catalyst for getting the children to explore and resolve personal and social problems. For example, during the sessions, the class talked about many school and family conflicts that were confronting them. The open discussion and role playing techniques that were employed enabled the youngsters to plan appropriate behavioral strategies for coping with these difficulties. In the investigator's opinion, this was the greatest strength of the anecdotal approach since it helped the children to deal more effectively with many of the problems that they were experiencing in their own lives.

References

Anderson, J., & Schmidt, W. A time for feelings. Elementary School Guidance and Counseling, 1967, 1, 47-56.

Bedrosian, O., Sara, N., & Pearlman, J. A pilot study to determine the effectiveness of guidance classes in developing self-understanding in elementary school children. Elementary School Guidance and Counseling, 1970, 5, 124-134.

Howard, W., & Zimpfer, D. The findings of research on group approaches in elementary guidance and counseling. Elementary School Guidance and Counseling, 1972, 6, 163-169.

Jones, V. Character education through cases from biography. Boston: Ginn and Company, 1931.

Lavin, P. Anecdotes to develop social and self awareness with elementary school children. Midland, Michigan: Pendell Publishing Company, 1973.

McBrien, R., & Nelson, R. Experimental group strategies with primary grade children. Elementary School Guidance and Counseling, 1972, 6, 170-174.

ANECDOTAL GROUP COUNSELING WITH SOCIALLY MALADJUSTED FOURTH, FIFTH, AND SIXTH GRADE BOYS: EXPERIMENT II

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Although the use of group counseling in the elementary school has been rapidly increasing, so far the results have been conflicting. For example, in their attempts to improve the social adjustment of problem children, Kranzler and his associates (1966), Mayer, Kranzler, and Matthes (1967), Biasco (1965), and Kelly and Matthews (1971) found no significant differences in favor of the treatment. However, the studies by Hansen, Niland, and Zani (1969), Hinda and Roehlke (1970), and Strickler (1964) showed that children exposed to group counseling improved significantly in this area.

As Howard and Zimpfer's (1972) review of the literature on group approaches indicates, the effectiveness of group counseling as a technique for helping elementary school pupils to make a better social adjustment is an issue which is yet to be resolved. It would seem reasonable to assume that this approach would be worthwhile with fourth, fifth, and sixth grade pupils since the child's ability to understand group processes, and his ability to function in a group are fairly well developed by this time (Jersild, 1960, p. 201; Hurlock, 1964, p. 336). Thus, in the light of what is known about child development, group counseling with older children makes good sense because these youngsters are ready for this kind of an experience.

As the preceding suggests, fourth, fifth, and sixth grade pupils could benefit from group counseling. Up until this time, however, only a few researchers have been successful in the implementation of their approach in the elementary school setting. This might indicate that the technique that is used in group counseling could be responsible for the results that occur.

In his discussion on counseling children in groups, Ohlsen (1968) points to the importance of structure, and the need for more active participation by the counselor in working with elementary school youngsters. In the studies conducted by Mayer, Kranzler, and Matthes (1967), Kranzler and his associates (1966), and Winkler, Teigland, Munger, and Kranzler (1965), a non-directive counseling approach was used, and null results were reported. However, in the studies conducted by Hansen, Niland, and Zani (1969) and Hinds and Roehlke (1970), a more direct approach was tried, and results favoring the treatment occurred.

The preceding might suggest that Ohlsen's recommendation is a valid one, and that a more structured approach to group counseling could produce positive results with children in the school setting. It might further indicate that more planned programs which can serve as a catalyst for getting pupils to discuss problems are needed.

As the research indicates, group counseling can be effective in helping youngsters to make a better personal and social adjustment. However, like all techniques, it must be adapted to the needs of the participants if the desired outcomes are to occur.

Purpose of Study

The purpose of this study was to determine whether the use of anecdotes in group counseling was an effective technique for helping socially maladjusted fourth, fifth, and sixth grade boys to make a better social adjustment. It was hypothesized that boys who received group counseling with anecdotes would score significantly higher on the Lavin Scale of Social Adjustment than boys who received only group counseling.

The anecdotes that were used in this study were written by the investigator. They consisted of a series of short stories about boys who engaged in behavior which was aversive to those persons with whom they interacted.

Selection of Subjects

In order to select the subjects for this study, the investigator administered a Guess Who test to nine classes of fourth, fifth, and sixth grade students. In this test eleven statements describing "good" behavior and eleven statements describing "poor" behavior were presented to the pupils. The children were asked to write the name of the boy or girl in their class whom they thought each statement best described.

The following procedure was used in scoring the test. A + 1 score was given when a child was identified as possessing a positive characteristic, and a - 1 score was given for the possession of a negative characteristic. Composite scores for each youngster were obtained by subtracting the total number of pluses from the total number of minuses.

After the individual scores were computed, the median score for each class was determined. For experimental purposes, those pupils falling below the median were identified as socially maladjusted.

Those boys whose scores fell below the median for their class and had agreed to participate in the experiment comprised the population for this study. From this population, a random sample of ten subjects from each grade level was drawn. Five of these boys were then randomly assigned to anecdotal group counseling (the experimental group) leaving the remaining five boys to be assigned to group counseling (the control group). Thus, one experimental and one control group were formed for each grade level with a total of three experimental and three control groups in all.

Instrumentation

The Lavin Scale of Social Adjustment, an instrument developed by the investigator, was used as the pre and posttest in this study. This test contains twenty items describing particular problem situations peculiar to children in the elementary school.

In each of the items, the subjects were asked to indicate how a hypothetical main character should go about dealing with the difficulty confronting him. A main character was used so that the subjects could indicate through him how they would handle the problem. It was felt that this approach would be less threatening than directly asking the children how they might resolve the difficulty. It was further assumed that the subjects were actually putting themselves in the place

of the main character and that the solutions that they proposed for him were the solutions that they would also propose for themselves.

The answers that were given were scored according to a 2, 1, 0 scheme. A score of 2 was given when the subjects indicated that the main character should engage in a positive social behavior in solving the problem. A positive social behavior would be one indicating responsibility, sympathy, politeness, honesty, and so forth. One point was given for an answer which was not considered to be the most appropriate way to solve the problem or for an answer which was not complete. Zero points were given when the subject indicated that the main character should engage in a negative social behavior such as lying, cheating, stealing, and so forth.

In order to account for possible differences in interpreting the answers, the investigator and one other counselor scored the tests. A final score for each child was computed by averaging the results. A series of six Pearson product-moment correlations were used to assess the degree of reliability between the investigator's and the other counselor's scores. The results showed that these correlations ranged from .79 to .98.

In validating this instrument, the technique referred to as content validity by Cronbach (1960, pp. 364-366) was used. The works of Fromm (1947), Thompson (1962), Hurlock (1964), English (1967), Peck and Havighurst (1962), and a number of other sources were consulted in order to determine what constituted appropirate and inappropriate social behavior.

Treatment Procedures

The experimental and control groups were scheduled for two, thirty minute counseling sessions for twelve weeks. The investigator served as the counselor for all of the groups.

In counseling with the experimental subjects, one tape recorded anecdote was presented at the beginning of each session. In each of the anecdotes, a boy with a particular behavior problem was described. When the tape was completed, the counselor used a direct approach in working with the children. Questions were asked about the causes of the main character's behavior, the effect that his behavior had on other persons, the defenses that he used, and the kinds of behavior that he might engage in to help him to resolve his difficulties.

Responses which indicated that the subjects were able to apply the anecdote to an actual school or life situation, and responses that indicate that the subjects understood what had happened in the anecdotal situation were positively reinforced with "good," "excellent," or some other form of praise. It was hoped that the anecdotes would serve as a catalyst for helping the children to understand their feelings, their attitudes, and their behavior and they they would share these with the other members of the group during the counseling sessions.

In counseling the control groups, group counseling without anecdotes was used. During these sessions, the counselor attempted to focus on the same topics that were discussed with the experimental groups. At the beginning of the session, one topic concerned with maladaptive behavior was presented for discussion. Direct questioning concerning the effects of this kind of behavior, and positive

reinforcement for appropriate responses were used by the counselor.

Analysis of Data

In order to determine whether those boys who received group counseling with anecdotes improved more significantly in social adjustment than boys who received only group counseling, an analysis of covariance was computed. The scores obtained on the pretest were used as the covariate. In order for a significant difference to occur, it was decided that the .05 level of confidence had to be reached.

Results

As Table 1 indicates, the results of this study suggest that anecdotal group counseling was not as effective as group counseling. A comparison of the experimental and control groups showed that there were no significant differences between them. When comparisons were made between the experiental and control children from each of the grade levels, the results showed that there were no significant differences between the fifth and sixth grade groups. A significant difference favoring the control treatment was reported for the fourth graders, however.

The superiority of the control treatment was further reflected in the analysis of the gain scores presented in Table 2. In each of the comparisons that were made, the control subjects made greater gains on the Lavin Scale of Social Adjustment.

TABLE 1

F-Values for Difference Between Counseling Treatments

Treatment	F
Anecdotal Group Counseling vs Group Counseling for fourth, fifth, and sixth grade boys	2.29
Anecdotal Group Counseling vs Group Counseling for sixth grade boys	.49
Anecdotal Group Counseling vs Group Counseling for fifth grade boys	.32
Anecdotal Group Counseling vs Group Counseling for fourth grade boys	13.84*

*$p < .01$

TABLE 2

Differences Between Pre and Post-means

Groups	Pre-means	Post-means	Differences
Experimental			
4th gr. (N=5)	15.7	19.0	+3.3
5th gr. (N=5)	22.5	23.0	+ .5
6th gr. (N=5)	25.1	24.1	-1.0
Total Group (N=15)			
Controls			
4th gr. (N-5)	19.7	25.1	+5.4
5th gr. (N=5)	23.3	25.7	+2.4
6th gr. (N=5)	21.9	23.0	+1.1
Total Group (N=15)			

Conclusions

As the preceding indicates, the subjects who received group counseling made greater gains in social adjustment than those youngsters who received counseling with anecdotes. The approach that was used with them might account for their superior performance. Although structure was provided for the control groups, it was not as rigid as that which was imposed upon the experimental groups. Instead of focusing on a main character's aversive behavior, they were able to discuss aversive behavior without having to apply it to an anecdotal situation. Thus, these youngsters had more freedom to direct and to determine the content of the discussions. This freer atmosphere might have generated more self-exploration on the part of the control children, and this might have been responsible for the greater social insight exhibited by them.

The preceding might suggest that the degree of structure that is imposed upon the group can be a determining factor in counseling effectiveness. As was indicated previously, the non-directive approach may not have been effective with socially maladjusted youngsters because it did not provide enough structure. The experimental technique that was employed in this study may have provided too much structure thus making it ineffective. The method that was used with the control children showed some potential, however. In this approach enough stimulation was provided to stimulate discussion, yet it allowed the children sufficient freedom so that they could explore those areas which were of immediate concern to them. The results of this study might suggest that group counseling can be effective with socially maladjusted children. However, more research is needed to determine the efficacy of this approach.

One final point is worthy of note. Even though the results of this study did not favor the experimental treatment, there is evidence to indicate that the anecdotal approach can be effective with socially maladjusted children. For

example, in a recent group guidance experiment (Lavin, 1974) based on a program developed by the investigator (Lavin, 1973), two thirds of the youngsters who fell below the median on the Lavin Scale of Social Adjustment made significantly higher posttest scores after receiving the treatment. This might suggest that the anecdotal approach can be effective provided that it is properly applied.

In this study, the kinds of problems that the subjects exhibited mitigated against the proper application of the treatment. For example, almost all of the experimental youngsters were very active and frequently did not attend to the task at hand. They often reinforced each other for anti-productive rather than productive behavior. Since only socially maladjusted subjects were selected for this experience, some of the groups did not contain youngsters with the social skills and insights who could assist them in improving their performance. As a result, they did not learn those behaviors essential to effective group functioning and generally did not appear to profit from the treatment. In the investigator's opinion, the anecdotal approach has the potential to affect a positive change in social adjustment provided that it is used with groups containing normal as well as problem children. However, more experimentation is needed to determine the conditions under which the technique might be most effectively applied.

References

Biasco, F. The effects of individual counseling, multiple counseling, and teacher guidance upon the sociometric status of children enrolled in grades four, five, and six. Unpublished doctoral dissertation, Indiana University. 1965.

Cronbach, L.J. Essentials of Psychological Testing. New York: Harper and Row, 1960.

English, H.B. Dynamics of Child Development. New York: Holt, Rinehart, and Winston, 1967.

Fromm, E. Man for Himself. New York: Rinehart and Company, 1947.

Hansen, J.C., Niland, R.M., & Zani, L.P. "Model-reinforcement in Group Counseling with Elementary School Children," Personnel and Guidance Journal, 1969, 47, 741-744.

Hinds, W.C. & Roehlke, H.J. "A learning theory approach to group counseling with elementary school children." School Counselor, 1970, 17, 49-55.

Howard, W. & Zimpfer, D. "The findings of research on group approaches in elementary guidance and counseling." Elementary School Guidance and Counseling, 1972, 6, 163-169.

Hurlock, E.B. Child Development. New York: McGraw-Hill Book Company, 1964.

Jersild, A.T. Child Psychology. Englewood Cliffs,N.J.: Prentice Hall, 1960.

Kelly, E.W. & Matthews, D.B. "Group counseling with discipline-problem children at the elementary school level." School Counselor, 1971, 18, 273-278.

Kranzler, G.D., Mayer, G.R., Dyer, C.O., & Munger, P.F. "Counseling with elementary school children: an experimental study," Personnel and Guidance Journal, 1966, 44, 944-949.

Lavin, P. Anecdotal group guidance with a fifth grade class. Unpublished study, Towson State College, 1974.

Lavin, P. Anecdotes to Develop Social and Self Awareness with Elementary School Children. Midland, Michigan: Pendell Publishing Co., 1973.

Mayer, G.R., Kranzler, G.D. & Matthes, W.A. "Elementary school counseling and peer relations," Personnel and Guidance Journal, 1967, 46, 360-365.

Ohlsen, M.M. "Counseling children in groups," School Counselor, 1968, 15, 348-349.

Peck, R.F., & Havighurst, R.J. The Psychology of Character Development. New York: John Wiley and Sons, 1962.

Strickler, E. Educational group counseling within a remedial reading program. Unpublished doctoral dissertation, University of Southern California, 1964.

Thompson, G.G. Child Psychology, Boston: Houghton Mifflin, 1962.

Winkler, R.C., Teigland, J.J., Munger, P.F. & Kranzler, G.D. The effects of selected counseling and remedial techniques on underachieving elementary school students. Journal of Counseling Psychology, 1965, 12, 384-387.

A GROUP CONTINGENCY PROGRAM TO ENHANCE CLASSROOM CREATIVITY

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Abstract

Twenty 5th grade students randomly assigned to four training groups were exposed during a 10-minute training period for 3 successive days to one of four reinforcement programs designed to modify the novely and elaboration of forms produced in a picture drawing task. Subjects for whom novel-form drawings were reinforced increased production of novel forms, while subjects for whom an incompatable response (stereotyped pictures) were reinforced decreased their production of novel forms. No reinforcement effects were found for contingency-related form elaboration. Overall, these findings are consistent with a social learning analysis of creative behavior and suggest that classroom contingency management programs could be an effective means of enhancing the "creative potential" of pupils.

Recently, formulationsof creative behavior developed within the framework provided by social learning theory have received increasing attention (e. g., Funderburk, Jans, & Fowler, 1975). The model proposed by Funderburk et al. (1975) holds that creative behavior systems can be viewed as predictable outcomes of traditionally conceived learning processes. Consistent with such a model, Goetz and Baer (1973) and Goetz and Salmonson (1972) demonstrated that the creative play of nursery school children could be controlled by reinforcement contingencies. Funderburk (1974) extended these findings to older children in a classroom setting using a large-scale contingency management program. In addition, both Goetz and Baer and Funderburk found that these schedule-induced changes generalized to other aspects of creative behavior.

These findings provide support for several of the predictions derived from the social learning model of creative behavior outlined by Funderburk et al. Specifically, they demonstrate that novelty of form production can be affected by contingent consequences provided by a variety of social agents for such behavior and that the performance patterns thus established can generalize to other tasks. Other characteristics of creative performance, however, have received little attention. One might wonder, for example, the extent to which reinforcement operations could override instructional sets for creative behavior, or whether the elaboration of novel responses could be affected by reinforcement contingencies. In this regard, Fowler, Jans, and Funderburk (1975) reported that social reinforcement could enhance the production of novel responding, even when these operations were superimposed upon a baseline performance established by a strong instructional set which encouraged a high level of novel response. Further, a brief shaping procedure, which was designed to enhance the elaboration of novel responses, appeared to be successful for some subjects.

The present study was concerned with the extent to which a classroom contingency program could simultaneously modify both the novelty and elaboration of forms produced in a picture drawing task.

Method

Subjects

Forty-three students attending the fifth and sixth grade at the Lida Lee Tall Learning Resources Center, Towson, Maryland, comprised the initial sample for this study. Due to scheduling difficulties the training procedure was not completed for the sixth grade subjects. The present report, therefore, will consider only the fifth grade students who completed the entire training program (n=20).

Materials

The picture drawing task was adapted from Torrance's (1962) Circles Test (CT). The subjects were provided with mimeographed pages containing twelve circles 38.1 mm (1-1/? in.) in diameter. Additional forms were available for any subject who requested them. The subjects were instructed as follows:

"In 10 minutes seehow many objects you can make from the circles on the page in front of you. A circle should be the main part of whatever you make. With pencil or crayon add lines to the circles to complete your picture. Your lines can be inside the circle, outside the circle, or both inside and outside the circle. Try to think of things that no one else will think of. Make as many things as you can and put as many ideas as you can in each one. Add labels or titles if the identity of the object is not clear."

Design and Procedure

Subjects were randomly assigned to four groups based on the type of response which was reinforced. In the novel-elaborate (NE) condition subjects received points for picture constructions which were both novel (i. e., pictures which were not duplicated during a given session) and elaborate (i. e., pictures which contained more than four "detail-elements"). In the novel-simple (NS) condition subjects received points for picture constructions which were both novel and simple (i. e., contained fewer than four "detail-elements"). In the stereotypy-elaborate (SE) condition subjects received points for picture constructions which were both stereotyped (i. e., repeated during a given experimental session) and elaborate. In the stereotypy-simple (SS) condition subjects received points for picture constructions which were both stereotyped and simple. In addition, all subjects received written comments which reflected the contingencies which were in effect for their group (e. g., "Good, these are different and elaborate", for the NE group).

All subjects were given a pretest in order to establish a basepoint against which the effects of the training procedure could be assessed. This was followed by three training sessions on successive days during which the contingencies which defined the experimental groups were in effect. Performance on the final training day was taken as the posttest measure. During these training sessions the CT was administered by one of the experimenters to the subjects as a group and

collected at the end of the 10-minute interval. Subjects were given performance feedback the following day, prior to the next training session. During this feedback period, the test papers from the previous session were returned to the subjects. Correct responses were marked on the subject's test paper with a check and the total number of correct responses was combined into a single score which was circled at the top of the page. The subjects were allowed several minutes to examine their papers before returning them and starting the next training session.

Results

Not all subjects who were exposed to the training program demonstrated an effect of such training. Six subjects (about 30% of our sample) showed no change from pre- to posttest assessments, using as a criterion a change of 2 responses in either direction. Apparently, our operations had no significant effect on these subjects. Our primary purpose, however, was to investigate the effects of (functional) reinforcement operations rather than the bases of individual differences in sensitivity to such operations. These subjects, therefore, were excluded from most subsequent analyses.

Analysis of the effect of reinforcement contingencies on novel responding was carried out by comparing the mean posttest performance (number of novel responses) for the groups reinforced for novelty (NS and NE) with that of the groups reinforced for stereotypy (SS and SE). This analysis revealed that the subjects whose novel responses were reinforced produced significantly more novel responses than did subjects for whom an incompatable response was reinforced (one tailed $\underline{r}=1.83$, $df=12$, $p<.05$). (A covariance analysis, using pretest score as covariate and posttest score as the dependent variable found a comparable result. As can be seen in Figure 1, both groups began training

See Figure 1

at approximately the same level. After only three training sessions, however, the novelty-reinforced groups increased their output of novel responses while the stereotypy-reinforced groups decreased their output of novel responses. No statistically reliable effect on contingency-relevant elaboration responding was found in the present study. However, it is interesting to note that based on the pretest data of the initial sample ($n=43$), there is a small but statistically reliable positive correlation between novel response production and novel-elaborate response production ($\underline{r}=.32$, $df=41$, $p<.05$), suggesting that these dimensions of creative behavior are not independent.

Discussion

In the present study a brief classroom contingency program was found to modify novel form production in children's drawings, even though these operations were superimposed upon a strong instructional set. Such an outcome is consistent with and extends the findings reported by a number of researchers who view creative behavior within a social learning framework (Fowler, et al., 1975; Funderburk, 1974; Funderburk, et al., 1975; Goetz & Baer, 1973; Goetz and Salmonson, 1972.

The failure to find an independent elaboration effect in the present investigation is puzzling, and could be due to a number of factors. Perhaps the most

likely reason for such an outcome was the brevity of the training program. In all, subjects were exposed to only 3 training sessions. Although Fowler et al. (1975) were able to increase elaboration of novel responses in a relatively brief period of time, their procedure used immediate rather than delayed social reinforcement. Even then, it appeared to be more difficult to gain schedule control of response elaboration than novelty. The operations in the present procedure then may simply not have been potent enough to demonstrate such control within 3 brief sessions.

Nevertheless, the present findings suggest that even a relatively brief contingency program can be effective in controlling at least some features of the creative behavior of many children in a classroom setting. Apparently, such reinforcement operations can override the effects of instructions to produce novel responses. The present findings are consistent with a social learning model of creative behavior and suggest that contingency management techniques could be quite useful for teachers interested in enhancing the "creative potential" of their pupils.

References

Fowler, M. J., Jans, J. E., and Funderburk, F. R. An operational procedure for novel response enhancement. Paper in prepartion for ERIC files.

Funderburk, F. R. Reinforcement control of classroom creativity. Paper presented October, 1974, Fifth Annual Kansas Symposium on Behavior Analysis and Education. Kansas City, Mo.

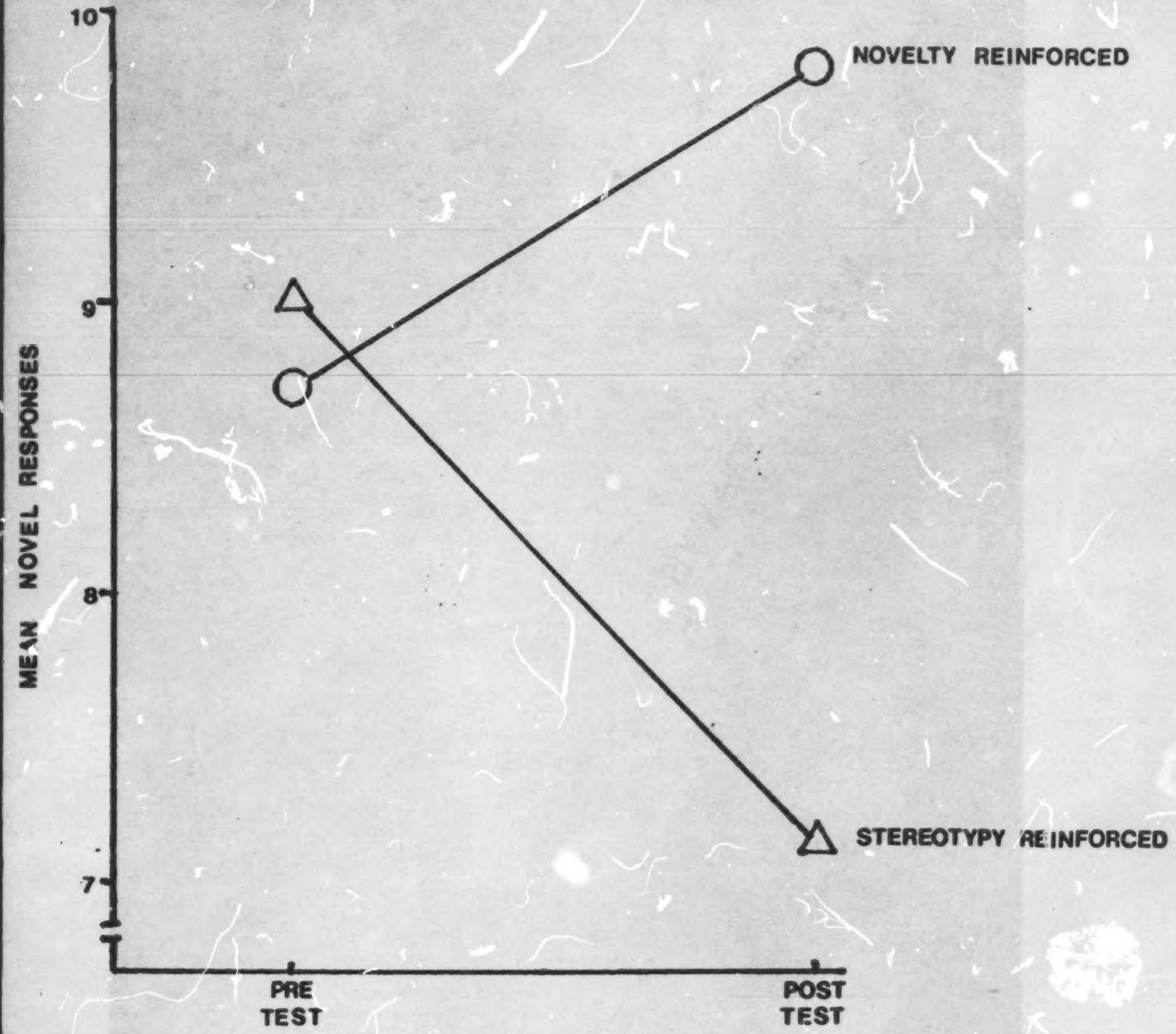
Funderburk, F. R., Jans, J. E., and Fowler, M. J. A social learning analysis of creative behavior. Paper presented May, 1975, Midwestern Association for Behavior Analysis. Chicago, Ill.

Goetz, E. M., and Baer, D. M. Social control of form diversity and the emergence of new forms in children's block building. Journal of Applied Behavior Analysis, 1973, 6, 209-217.

Goetz, E. M. and Salmonson, M. M. The effect of general and descriptive reinforcement on "creativity" in easel painting. In G. Semb (Ed.), Behavior analysis and education: 1972. Lawrence: University of Kansas, 1972.

Torrance, E. P. Guiding creative talent. Englewoods Cliffs, N. J: Prentice, Hall, Inc., 1962.

Figure 1: Change in mean number of novel responses per session as a function of reinforcement contingencies during training.



THE RELATIVE EFFECTS OF INDEPENDENT VERSUS INTERDEPENDENT GROUP CONTINGENCIES

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Abstract

This study investigated the relative effects of independent versus interdependent group contingencies. Thirty children equally selected at random from the third and fourth grades at the Lida Lee Tall Learning Resources Center at Towson State University served as subjects. A stratified random sampling was obtained by randomly assigning five children from each of the two grades to each of three treatment groups.

The experimental design was a three by two factorial design with three levels of reinforcement. In the independent contingency group, subjects were reinforced according to their own individual performances on the task. In the interdependent contingency group, subjects were reinforced according to the mean of group members' performance on the task. No reinforcing contingency was in effect for the control group. The task the subjects performed was to cross out rows of zeros with "X's." Six trials of two minutes each were administered individually to the three groups. Reinforcement followed each trial in the independent and interdependent contingency conditions.

An analysis of variance indicated that both the independent and interdependent group contingencies were significantly more effective than the control condition. No significant difference could be found between the two contingency conditions. Several methodological deficiencies which could have minimized the differential effects of the treatment condition may have been responsible for this result. Several significant interaction effects for grade and treatment were found but because no pattern for the interactions could be identified, no interpretation is offered.

Currently, there is an abundance of research indicating that operant conditioning techniques may be effectively applied in classroom settings. The early work in this area was concerned with the application of operant conditioning techniques to individual students.

Encouraged by the success of such applications, psychologists and educators considered applying these same operant techniques to groups of children. Levin (1973) outlines three potential benefits of the application of successful group contingencies. First, teacher efficiency in terms of time and effort in managing the collective responses of a group is greater than managing the individual responses of each child in the group. A second advantage would be the increased cooperative peer interaction that may form and increase as a result of reinforcing the whole group. Third, the combination of a group reinforcer with peer pressure may increase the overall potency of the contingency.

Litow and Pumroy (1973) reviewed the literature which investigated the several types of group contingencies that have been used in classroom settings. The most interesting of these studies have involved direct empirical comparisons of independent group contingencies (IND) and interdependent group contingencies (INT).

An independent group contingency (IND) is established when each member of a group received consequences dependent upon his own performance regardless of the performance of other group members. Essentially, it consists of the simultaneous application of individual contingencies in the group setting.

An interdependent group contingency (INT) is established when identical response contingencies are simulataneously in effect for all members of the group but the contingencies are applied to the group as a whole. Each member is dependent upon a level or performance emitted by the collective group for contingent consequences.

Sixteen studies have investigated the relative effectiveness of independent and interdependent group contingencies. Of these, eight studies have reported no difference in the effectiveness of the two contingencies (Axelrod, 1973; Prentice, 1970; Herman & Tramontana, 1971; Levin, 1973; Turknett, 1971; Drabman, Spitalnik, & Spitalnik, 1974: Litow, 1974; and Grandy, Madsen, Jr., & De Mersseman, 1973). INT group contingencies were found to be more effective than IND contingencies in seven studies (Granbard, Lanier, Weisert. & Miller, 1971; Witte, 1971; Jacobs, 1970; Hamblin, Hathaway, and Wodarski, 1971; McNamara, 1971; and Long & Williams, 1973). Only one study has reported the greater effectiveness of IND versus INT group contingencies (Ruppert, 1972).

These studies suggest that INT group contingencies are at least as effective as IND group contingencies. It is important to note that studies of these two types of contingencies have been exclusively of an applied nature in the classroom setting. One difficulty with applied research is that the rate of displaying experimental control required of behavioral applications is considerably less than the standards typical of laboratory research (Baer et al., 1968). The comples environment and host of potential contaminating variables in the classroom can have a significant impact on the research results.

The purpose of the present study was to investigate the relative effectiveness of an INT group contingency versus an IND group contingency in a basic research design which will control for many of the contaminating variables present in the classroom setting.

Method

Subjects

The study was carried out at the Lida Lee Tall Learning Resources Center on the campus of Towson State University. Thirty children equally selected at random from the third and fourth grades served as subjects for the study. A stratified random sampling was obtained by randomly assigning five children from each of the two grades to each of three treatment groups.

Experimental Design

The experimental design was a three by two factorial design. There were three levels of reinforcement. For each grade, subjects were randomly assigned to one of three reinforcement levels. The three contingencies under which the subjects worked were as follows:

Independent contingency group (IND). In the IND contingency group, subjects were reinforced according to their own individual performance on the task.

Interdependent contingency group (INT). In the INT contingency group, subjects were reinforced according to the mean of group members' performance on the task.

Control group. No reinforcement contingency was in effect for the control group. Their performance did not receive the reinforcement presented to the experimental groups.

Procedure

The three treatment groups were seen individually on the same day and were isolated from one another by a teacher's aide until after completion of the experiment.

Each subject was given a Performance Sheet with 30 rows of zeros per sheet and 10 zeros per row. The task the subjects performed was to cross out each zero with an "X." In all conditions, the subjects were instructed to cross out the zeros in order, from left to right, and to follow the numbered sequence of the rows.

Each condition received six trials of two minutes each. The between trials period was equalized for all groups in order to control for differential fatigue and/or rest effects that could have been affected by variability of time intervals between trials for the different treatment groups. Successive trials were begun five minutes following the end of the preceding trial. At the end of each trial, the performance of each subject was determined and was recorded besides the subjects' names on a blackboard in full view of the subjects. Reinforcement was given to the two experimental groups at the end of each trial. Each subject in the IND group received one M&M candy for each row the child completely crossed out. In the INT condition, the total number of completely crossed out rows for the entire group was determined and one M&M candy was given to the group for each row. Subjects in the INT group equally shared the candies independent of their own individual performance. Subjects in both groups were instructed as to the contingencies under which they were operating. While no reinforcements were given to subjects in the control group, an amount of candies equal to the mean of that earned by the two experimental groups was given to each subject in the control group following the study for fairness and ethical considerations.

Results

In the present study, the reinforcement contingency served as the independent variable. The dependent measure was the number of rows completely crossed out by the subjects. A graphic representation of the results of the experiment is presented in Figure 1.

See Figure 1.

An analysis of variance was performed to determine if any significant differences among the treatment procedures could be identified. The results of this analysis is summarized in Table 1. The findings indicated that there was a significant main effect for the treatment procedures ($F = 4.66$, 2/24 df, $p < .05$). While the main effect of the subjects' grade level failed to reach significance, a significant interaction was evidenced between treatment and grade level ($F = 8.52$, 2/24 df, $p < .05$).

See Table 1.

The Tukey b technique was selected for testing the pair-wise contrasts. Table 2 presents the results of the analysis for pair-wise comparisons. The results indicate that the INT and IND group contingencies significantly differed from the control condition. However, the INT and IND conditions did not significantly differ from each other.

See Table 2.

Further analysis employing the Tukey b was conducted on the pair-wise comparisons of the interaction of the two independent variables. The results of this analysis are presented in Table 3. Fourth grade subjects in the IND contingency condition performed significantly better than did third grade subjects in the control condition.

See Table 3.

Figure 2 presents a graphic representation of the interaction effects of the two independent variables.

See Figure 2.

Discussion

The results of the present study have indicated that both the IND and INT group contingencies were significantly more effective than the control procedure in affecting the dependent variable. Thus, both treatment conditions proved to be effective reinforcement procedures.

Anecdotal data support the statistical findings that the M&M's served as effective reinforcers. In both the INT and IND contingency conditions, the experimenter noted that the subjects appeared enthusiastic about receiving the candies. Subjects frequently commented that they liked the candies and how they intended to earn a greater number of M&M's on each successive trial. At the end of the experimental session, subjects in both the IND and INT conditions indicated that they would have liked to continue with the task while no such indication was given by subjects in the control condition. The effectiveness of reinforcing the subjects with candies in the present study supports early behavioral work by Terrell (1958) that indicated that immediate candy is an effective reinforcer for subjects of the ages used in this study.

No difference was found between the two reinforcement procedures in affecting the subjects' performance on the dependent variable. There are several possible

interpretations for this result. One interpretation is that it makes no difference whether subjects are reinforced according to their individual performance or whether they equally share the rewards earned by their collective performance. As half of the studies investigating the relative effectiveness of these two contingencies have found no difference between them, this explanation may be correct.

A failure to detect a difference between the IND and INT group contingencies in the present study however, does not prove that no difference exists between such reinforcement procedures. The other half of the studies in this area have indicated that a significant difference between the two contingencies does exist. Thus, the possibility must be recognized that a difference between IND and INT contingencies does in fact exist but that such difference did not emerge in the present study. In considering this possibility, four explanations are offered as why such a result was not obtained.

The first possible explanation considers the sample size used in the present study. The relatively small sample size (N=30) decreased the power of the statistics used for detecting differences among the treatment groups (Dayton and Stunkard, 1971; Runyon and Haber, 1971). Differences between the two experimental conditions may have emerged had a larger sample been employed.

The second explanation of the result addresses the possibility of the subjects' limitation to respond to the reinforcers. In all conditions, the subjects approached the assigned task seriously. All subjects worked diligently and remained on task throughout the six trials. The complaints of writer's cramp and requests for longer intertrial periods on the part of the subjects indicated the extent of their efforts. The performance of the two contingency groups indicated that the subjects could increase their performance over that demonstrated by the control group. Nevertheless, there obviously is a limitation to the subjects capacity to perform the task. It appeared to the author that the subjects in the INT and IND conditions were operating at, or near, their full capacity to perform the task. If this is fact was true, the differential effects of the two reinforcement procedures would be limited by the subjects in the IND and INT conditions reaching their optimal level of performance before the full potency of the reinforcers could be determined.

Another variable that could have affected the result is the length of time spent on the task employed in the study. Each treatment group was in the experimental room for approximately 45 minutes and spent only 12 minutes performing the task. It is possible that greater differences among the treatments would have emerged using the same task but over a longer period of time. Increasing the number and/or length of the trials would have given a larger sample of the subjects' behavior.

Finally, there is some question as to whether the subjects in the INT condition completely comprehended the method of reinforcement used with their group. They clearly understood that the more rows they crossed out, the more M&M's they received as a group, yet the author is not certain that the subjects truly understood how the performance of each group member affected every other group member's reinforcement. The author neither saw nor heard any interaction within the group that would indicate the group's awareness of their schedule of reinforcement. No comments were heard encouraging group members to work for the benefit of the group

or acknowledging any individual contribution toward group performance. If in fact the subjects in the INT condition did not fully understand the method of reinforcement used with their group, differential effects between the treatment groups could have been effected.

Analysis of the interaction of grade and contingency effects indicated that there were several significant results. Fourth grade subjects in the IND contingency condition performed significantly better than did third grade subjects in the IND and control conditions and fourth grade subjects in the control condition. As the results of these interaction effects yield no apparent pattern, no interpretation of these results are offered at this time. Future research in this area, however, should analyze such interactions to determine whether any patterns emerge.

Implications and Suggestions for Future Research

As there is no conclusive evidence as to whether there are any significant differences in the effectiveness of IND versus INT group contingencies, further research in this area is needed. This study offered a basic research methodology for investigating the relative effects of these two contingencies. The methodology allowed for a far greater degree of control than is generally possible in applied research. Further basic research would be advisable to provide a balance for the applied research already performed.

The task used in the present study appears to be suitable for further basic research in this area if employed with several modifications. First, it would be advisable to extend the trial periods to allow for greater differential effects of the treatment conditions. This could be achieved for example, by having the subjects perform the task on a daily basis over a two week period. Five or ten minute trials also might increase the differential effects. A second modification would be to provide more comprehensive instructions to subjects in the INT condition to insure that they understand how they are to be reinforced. Finally, a larger sample size would increase the power of the statistics used to identify differences in the treatment groups performance. While this task may be used with these modifications, it would be advisable to employ a variety of tasks in order to identify those tasks most appropriate for such research.

The results of this study suggest that grade level may interact with the treatment conditions. Therefore, future research in this area should take into account the possibility that such interactions exist.

Selected Bibliography

Azelrod, S. Comparison of individual and group contingencies in two special classes. Behavior Therapy, 1973, 4, 83-90.

Baer, D.M., Wolf, M.M. and Risley, T.R. Some current dimensions of applied behavior analysis. Journal of Applied Behavior Analysis, 1968, 1, 91-97.

Bronfenbrenner, U. and Condry, J. Two worlds of childhood: U.S. and U.S.S.R., New York: Russell Sage Foundation, 1970.

Dayton, C.M. and Stunkard, C.L. Statistics for problem solving. New York: McGraw-Hill, 1971.

Drabman, R., Spitalnik, R., and Spitalnik, K. Sociometric and disruptive behavior as a function of four types of token reinforcement programs. Journal of Applied Behavior Analysis, 1974, 7, 93-100.

Granbard, P.S., Lanier, P., Weisert, H., and Miller, M.B. An investigation into the use of indigenous grouping as the reinforcing agent in teaching maladjusted boys to read. Final Report. Veshiva University, School of Education and Community Administration, June 1970, Project No. 8-0174, Grant No. OEG 8-08074-4353, USOE Bureau of Education for the Handicapped.

Grandy, G.S., Madsen, G.H., and DeMersseman, L.M. Contingencies on inappropriate classroom behavior. Psychology in the Schools, 1973, 10, 488-493.

Hall, R.V., Lund, D., and Jackson, D. Efforts of teacher attention on study behavior. Journal of Applied Behavior Analysis, 1968, 1, 1-12.

Hamblin, R.L., Hathaway, C., and Wodarski, J.S. Group contingencies, peer tutoring, and accelerating academic achievement. In E. Ramp and B.L. Hopkins (eds.), A new direction for education: Behavior analysis. Vol 1, Lawrence, KS.: The University of Kansas Support and Development Center for Follow Through, 1971., pp. 41-53.

Hart, B.M., Reynolds, N.J., Baer, D.M., Brawley, E.R., and Harris, F.R. Effect of contingent and noncontingent social reinforcement on the cooperative play of a preschool child. Journal of Applied Behavior Analysis, 1968, 1, 73-76.

Hays, W.L. Statistics. New York: Holt, Rinehart, and Winston, 1963.

Herman, S.H. and Tramontana, J. Instructions and group versus individual reinforcement in modifying disruptive group behavior. Journal of Applied Behavior Analysis, 1971, 4, 113-119.

Jacobs, J.F. A comparison of group and individual rewards in teaching reading to slow learners. Final Report. University of Florida, College of Education, June 1970, Project No. 9-0257, Grant No. OEG-4-9-190257-0045(010), USOE Bureau of Research.

Levin, L. A comparison of individual and group contingencies with third and fourth grade children. University of Maryland Counseling and Personnel Services Journal, 1972-73, 3, 22-24.

Litow, L. The effects of independent and low performance interdependent group contingencies on class attendance, on-task behavior, and academic performance. Unpublished masters thesis, University of Maryland, 1974.

Litow, L. and Pumroy, D.K. A conceptual schema of classroom group contingencies. University of Maryland Counseling and Personnel Services Journal, 1973, 3, 8-20.

Long, J.D. and Williams, R.L. The comparitive effectiveness of group and individually contingent free time with inner city junior high school students. Journal of Applied Behavior Analysis, 1973, 6, 465-474.

McNamara, J.R. Behavioral intervention in the classroom: Changing students and training a teacher. Adolescence, 1971, 6, 433-44-.

Myers, J.L. Fundamentals of experimental design. Boston: Allyn & Bacon, 1966.

Prentice, B.S. The effectiveness of group versus individual reinforcement in shaping attentive classroom behavior. Unpublished doctoral dissertation, University of Arizona, 1970.

Redd, W.H. Effects of mixed reinforcement contingencies on adults' control of childrens' behavior. Journal of Applied Behavior Analysis, 1969, 2, 249-254.

Reese, H.W. Multiple comparison method. American Psychologist, 1970, 25, 365-366.

Runyon, R.P. and Haber, A. Fundamentals of Behavioral Statistics. Reading: Addison-Wesley Publishing Co., 1971.

Ruppert, M.F. A study of the effect of individual and group rewards for appropriate social classroom behavior upon social classroom behavior in a junior high school setting. Unpublished doctoral dissertation, American University, 1971.

Staats, A.W., Minke, K.A. and Butts, P. A token-reinforcement remedial reading program administered by black therapy--technicians to problem black children. Behavior Therapy, 1970, 1, 331-353.

Terrell, G. The role of incentive in discrimination learning in children. Child Development, 1958, 38, 321-336.

Turknett, R.L. A study of differential effects of individual versus group reward conditions on the creative productions of elementary school children. Unpublished doctoral dissertation, University of Georgia, 1971.

Whitlock, C. Note on reading acquisition: an extension of laboratory principles. Journal of Experimental Child Psychology, 1966, 3, 83-85.

Whitte, P.H. The effects of group reward structure on interracial acceptance, peer tutoring and academic performance. Unpublished doctoral dissertation, Washington University, 1971.

Figure 1

Mean Number of Rows Crossed Out by Treatment Condition

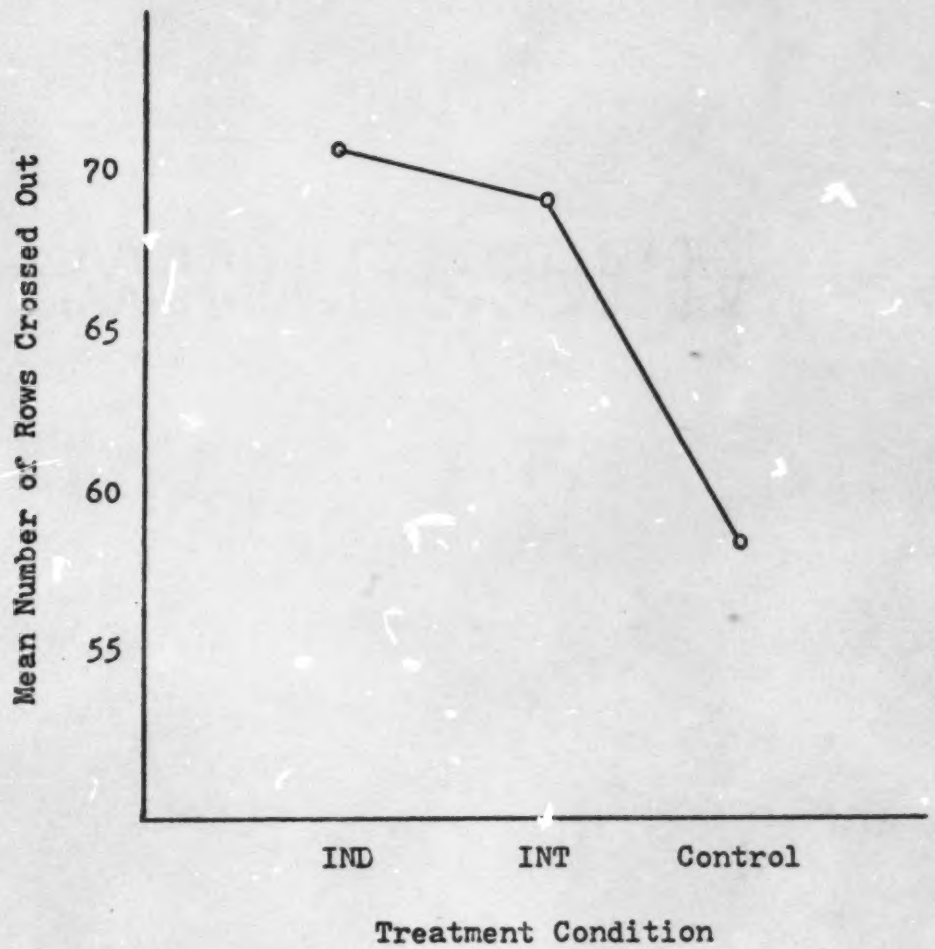


Table 1

Analysis of Variance Summary Table for
Number of Rows Crossed Out

Source	d.f.	MS	F
Treatment	2	421.7	4.66*
Block	1	307.2	3.39
T x B	2	771.9	8.52*
Within Cells	24	90.6	

*$p < .05$

Table 2

Tukey b Values for the Comparison of the Mean Number of Rows Crossed Out Per Group

Group	N	Mean	Group		
			IND	INT	Control
IND	10	70.1	-	1.7	12.0*
INT	10	68.4		-	10.3*
Control	10	58.1			-

*p <.05

$qr_2 = 9.69$

$qr_3 = 10.59$

Table 3

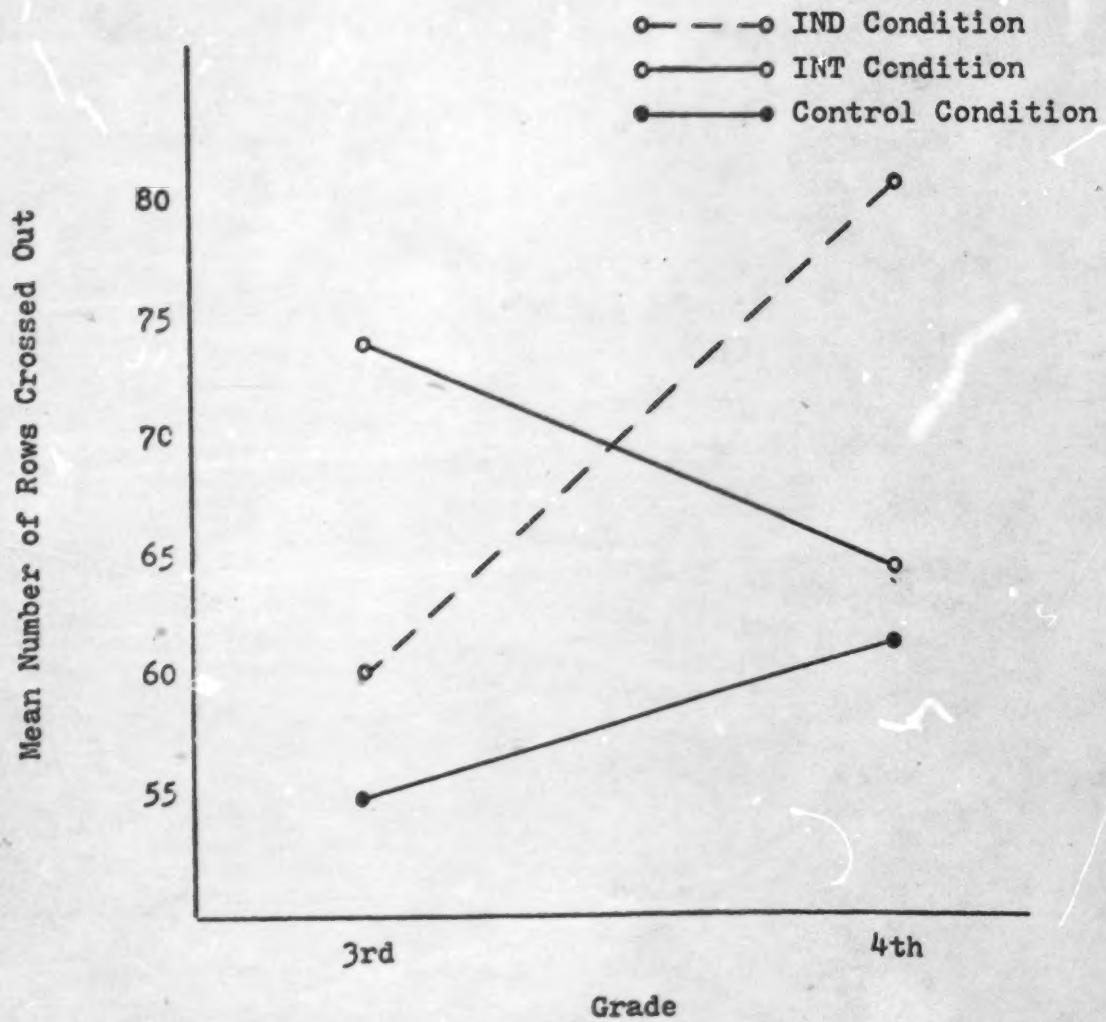
Tukey b Analysis for Grade x Contingency Effects

Group	Mean	Group						
		IND 4th Grade	INT 3rd Grade	INT 4th Grade	Control 4th Grade	IND 3rd Grade	Control 3rd Grade	
		80.6	73.0	63.8	61.8	59.6	54.4	
IND 4th Grade	80.6	-	7.6	16.8	18.8*	21.0*	26.2*	r_2 = 15.7
INT 3rd Grade	73.0		-	9.2	11.2	13.4	18.6*	r_3 = 17.0
INT 4th Grade	63.8			-	2.0	4.2	9.4	r_4 = 17.8
Control 4th Grade	61.3				-	2.2	7.4	r_5 = 18.4
IND 3rd Grade	59.6					-	5.2	r_6 = 18.8
Control 3rd Grade	54.4						-	

*p < .05

Figure 2

Interaction Effects of the Independent Variables



THE EFFECTS OF MODELING ON THE PERSONAL SPACE OF ELEMENTARY SCHOOL CHILDREN

Ronald B. Golkow

Personal space can be defined as an area possessed by a person which is effected by other individual's body movements, how individuals maintain interactions with that person, and the physical distance between a person and other individuals. Previous research has coined the term, personal space (Katz,1937), and integrated it into the territoriality concept (Lewin, 1935; Stern, 1935). Earlier studies (Darling, 1937; Howard, 1920) observed animal territoriality, as a geographical concept, while incorporating into this concept "spacings" between organisms. McBride and Foenander (1962) studied the relationship between the pecking order and physical distance in domestic fowl. In the study, physical boundaries between two groups of fowl were removed, after which fowl in the less desirable territory tried to establish new boundaries in the territory of the other group of fowl. This relocation of boundaries was not successful because of the physical violent attacks of the fowl, in the more desirable territory, upon the invading group of fowl. With domestic hens, McBride, James and Schoffner (1963) concluded that animals do not space themselves at random. It is the orientation of a hen's head that influences behaviors in the immediate environment. The relationship between the pecking order in fowl, and the characteristic approach distance between fowl has also been demonstrated (King, 1965). King found that, under food deprivation conditions, fowl are willing to violate usual approach distances. Under these conditions, fowl, lower in the pecking order, will reduce the usual approach distance with another fowl to obtain food.

Sommer (1969) suggested a logical extension of territoriality to humans, in which he defined various spatial human relations as personal space. Sommer differentiated between personal space and territoriality. While personal space is territory, it is mobile, invisible, and focuses upon the individual. Contrary to this, territoriality is a static form of area, visible to everyone, and not requiring the individual to be its focal point.

Another researcher, Hall (1959, 1966), defined personal space as proxemics, the scientific study of behavior in man, which he represented by four concentric bubbles called zones. These zones were intimate, personal, social, and public. In the intimate zone, lovemaking and aggression may be observed, while in the personal zone, interactions with friends, or being at cocktail parties may occur. The last zones, social and public, were illustrated by impersonal business transactions and formal non-communicative transactions, respectively.

A study by Little (1965) had little success in replicating Hall's (1959, 1966) findings. According to the situation given to them, subjects performed three tasks, two of which involved either placing statuettes against no background, or an appropriate scenic background. The last task consisted of directing university student actresses. Results suggested that personal space funtioned according to the type of interaction, and the degree of intimacy. The influence of the perceived interaction's settings was apparent in the physical distance between silhouettes. The maximum silhouette distance occurred in office waiting rooms. However, a comparison of minimal distance in different situations suggested that

street corners, or similar open air settings elicited the closest interactions. These conclusions were more profound for females than males. In addition, females viewed acquaintances in much the same manner as strangers, which was subsequently influenced by the settings. On the other hand, males viewed friends and acquaintances as equals, regardless of the settings.

In another study (Horowitz, Duff & Stratton, 1964) a body-buffer zone theory was suggested as an explanatory model of personal space. Horowitz et al. demonstrated how such variables as the proximity of the individual, their attitudes towards the individual, and any internal drives operating at that time effect an individual's personal space. In a broader sense then, personal space has been viewed as expanding or contracting bubbles or rings, which the individual defines with respect to others, relationships, and activities (Leibman, 1970).

Measures

Several different procedures have been employed by researchers to investigate personal space, Kuethe (1962, 1964, 1964a) hypothesized a relationship between physical distance on a feltboard and psychological distance. Through this relationship, a researcher could describe how an individual groups people, and at what physical distance. Kuethe termed this type of mental diagram as a social schema. Using Kuethe's technique, other researchers (Guardo, 1969; Meisels, and Guardo, 1969; Stratton, Tekippe & Flick, 1973; Weinstein, 1973) had subjects determine physical distance between figures, which were mobile and/or stationary. The authors could then begin to define how people organize schemas of people. Such a definition would need to encompass the conditions and types of people in which personal space functions. Levinger and Gunner (1967) later devised a variant of the Kuethe technique as a measuring tool. This variant measured interpersonal relationships on a plexiglas two dimensional grid, using Kuethe's feltboard technique as an index of intimacy. The authors suggested that more information and greater precision could be gained through this measuring tool. A second device that Levinger and Gunner originated would reduce the haste by the experimenter in removing the objects from the feltboard. In this tape technique, miniatures are taped onto a vertical feltboard. With the experimenter opposite the subject, who is adjusting the miniatures, scores from the grid could be quickly made.

Another measuring device is the Comfortable Interpersonal Distance scale (CID) (Duke & Norwicki, 1972). This measuring tool is a paper and pencil test that has been used with frequency (Petri & Huggins, 1975; Petri, Huggins, Mills and Barry, 1974; Sanders, 1975). The CID is a plane with eight radii, 80mm. long, projecting from a common point. Distance along the radii is easily measured in millimeters. Each radii is associated with an "entrance" and pathway into an imaginery room for imaginery people (stimuli). The task begins by asking the subject to imagine being the focal point for the radii. The subjects then mark on the radius concerned where they begin to feel uncomfortable with the closeness of the stimulus, and want the approach stopped. Personal space is then determined in much the same way as Kuethe (1962, 1964, 1964a). Even though the CID is not a variation of the Kuethe technique, it can be categorized with it, because it is essentially non-behavioristic.

Behavioral measures have also been implemented to estimate the physical distance (from an object) or the temporal duration of an activity. A number of studies

(Horowitz et al., 1964; Sommer, 1959; Stratton et al., 1973) employed animate and inanimate objects to observe personal distance. Other experimenters (Horowitz, 1965; Horowitz et al., 1964; Kinzel, 1970; Meisels & Dosey, 1971) examined how close a subject would allow others to approach, or how close they would approach others (Dosey & Meisels, 1969). Some authors (Bailey, Hartnett & Gibson, 1972; Bailey, Hartnett and &Glover, 1973; Hartnett, Bailey & Gibson, 1970) combined the two approaches in their studies. Moreover, the feltboard technique, or a variant of it, has also been used with behavioral measures (Dosey & Meisels, 1969; Horowitz et al., 1964; Little, 1965; Stratton et al., 1973). In this measurement combination, Hartnett et al. (1970) examined sexual differences. They had two confederates, male and female, approach the subject, thereafter, the subject approached the confederates. When the subject began to feel uncomfortable with the closeness during the approach, they told the confederates to stop, or they themselves stopped. After the task, subjects rated the confederates according to their attractiveness. Barefoot, Hoople and McClay (1972) observed various degrees of reluctance in subjects to invade another's personal space. In the study the experimenter sat, at varying distances, from a water fountain, reading a book while subjects were observed whether or not they stopped at the fountain. The degree of invasion was measured by the amount of time the subject activated the water fountain.

An earlier method that is still used today to study personal space is the naturalistic setting (Baxter, 1970; Blood & Livant, 1957; Sommer, 1959). Using this technique, investigators (Barash, 1973; Barefoot et al., 1972; Becker & Mayo, 1971; Felipe & Sommer, 1967; Fry & Willis, 1971; McDowell, 1972; Sommer & Becker, 1969) explored a variety of personal space invasions. Such settings used were park-like surroundings (Felipe & Sommer, 1967) and cafeterias (Becker & Mayo, 1971; Sommer, 1959). Fry and Willis (1971) used children to invade a waiting line of adults. The children were told not to initiate any conversations, or to show any awareness of the closeness they established. The authors then measured personal space among the adults through observations of their subsequent behavior.

Correlations have also been studied between personal space measures and the Galvanic Skin Response (McBride, King & James, 1965) and various personality variables as heterosexuality (Bailey et al., 1972; Hartnett et al., 1970), anxiety Bailey et al., 1972; Dosey & Meisels, 1969), hostility and aggression (Kuethe, 1964a; Pedersen, 1973b), and self-concept (Pedersen, 1973a; Stratton et al., 1973).

A number of investigators (Blumenthal & Meltzoff, 1967; Felipe & Sommer, 1967; Sommer, 1959; Tolor, 1970; Tolor & Donnon, 1969) have shown schizophrenics to have a distorted concept of personal space. Additionally, Felipe and Sommer (1967) observed reactions of flight or body repositioning on the part of schizophrenics when their personal space was violated. Horowitz (1968) suggested that personal space in schizophrenics was more acute in the initial period of hospitalization, when the patient was more defensive. This body-buffer zone however decreased as time lapsed.

Sommer (1959) and Horowitz et al. (1964) alluded to schizophrenics preferring a more distant seating arrangement, frequently avoiding verbal interactions, and generally maintaining a greater personal space. However, these same studies found schizophrenics maintaining smaller distances when confronting non-threatening objects. From his results, Sommer suggested that individuals withdrew to

normal physical distances when confronted by schizophrenics, thus leaving the schizophrenic person feeling rejected. Moreover, the schizophrenic's distorted personal space may be a social artifact. Consequently, it may be a product of mental hospital societies, where there is very little privacy and very little to possess.

Personal space in other populations has been studied too. Kinzel (1970) explored the differences in the size and shape of body-buffer zones in violent and non-violent prisoners. Using behavioral measures, violent prisoners were found to have a larger rear than frontal zone, while in non-violent prisoners, an opposite, but non-significant trend was found. Over a 12 week period, the zones of non-violent prisoners grew smaller, with the violent prisoner's zone remaining larger. Various personal space differences have occurred between normal children and disturbed children (Gerber, 1973; Tolor, 1968), in learning-problem children, (Gerber, 1973) and schizophrenic children (Goldfarb & Mintz, 1961). Weinstein's (1965) analysis of the social schemata of emotionally disturbed boys showed an inadequate development in the adult schemata. In another study (Newman & Pollack, 1973), deviants were found to demand more personal space than normal children.

In many cases, (Exline, 1963; Exline, Gray, & Schuette, 1964; Mehrabian, 1968; McBride et al., 1965; McDowell, 1972) eye contact had a positive relationship with physical distance. While Mehrabian (1968) found that eye contact increased between liked individuals, Exline (1963) demonstrated that females maintained more eye contact than males. Argyle and Dean (1965) asked subjects to view busts, the size of a human head, and life-size photographs of a male. Their results indicated subjects showed greater proximity to the life-size photograph of the person with his eyes shut, rather than open. More eye contact was also seen in various situations, such as when the subject discussed a less personal topic, and took a more passive role in the discussion, as in listening. Eye contact increased too, when the subject engaged with cooperative or affilitative persons, or interacted with a female.

In another study (Goldberg, Kiesler & Collins, 1969), eye contact and gazing was measured temporally in an unstructured interview between a subject and a confederate. The study's results, like those of McDowell (1972), coincided with those of the Argyle and Dean (1965) study, previously discussed.

Like Patterson (1968), Evans and Howard (1973) discussed attempts to correlate personal space in adult populations with different variables. One such variable is racial stereotyping. Kuethe (1964) hypothesized that when individuals are set apart in a group, it is difficult to think, in other ways, about those individuals such as intermingling them with one's own group. In this manner, prejudiced people categorize their thinking and tend to use grouping schemata. Tolor (1968) found further separation between mixed racial figures than between negro male and female figures on a feltboard. Anther study (Baxter, 1970) found that people congregate in areas according to their ethnic background. Mexican-Americans clustered more outdoors and blacks clustered more indoors, while whites congregated in both areas.

Inverse relationships have been found between physical distance (with another person) and variables, such as heterosexuality (Bailey et al., 1970; Hartnett

et al., 1970), impression formation (Patterson & Sechrest, 1970), and self-concepts (Stratton et al., 1973). Kleck, Buck, Goller, London, Pfeiffer and Vukcevic (1968) found that subjects had greater physical distance with confederates having no external signs of a handicap than those confederates that did. On another task, these same investigators found that confederates, who were known to have epilepsy, had more physical distance with subjects than the confederates, who were not known to have epilepsy.

Sommer (1959) was not able to find a clear trend in communication and distance. However, in seating arrangements, individuals communicated more when seated corner-to corner than when seated side-by-side. Subjects additionally preferred corner-to-corner over face-to-face seatings. While Lott and Sommer (1967) found that subjects seated themselves closer to peers than to confederates of high and low status, Barash (1973) found subjects maintaining greater distances and having earlier departure times with faculty dressed confederates than with student dressed confederates. Another study (Hartnett, Bailey & Hartley, 1974) observed less physical distance between subjects and a seated short object-person than a tall object-person.

On two other variables, hostility and aggression, Pedersen (1973a) found that less aggressive and hostile subjects displayed a smaller personal space. Two earlier studies demonstrated that subjects maintained greater physical distance with an experimenter that angered them (Meisels & Dosey, 1971), and that aggressive subjects placed male figures, with and without rifles, with female figures on a feltboard (Kuethe, 1964). On the last variable, Alligeier and Byrne (1973) demonstrated greater physical closeness between affilitative individuals than non-affilitative individuals.

Violations of personal space have been defined by Leibman (1970) as any physical placement or behavior that obstructs the personal completion of an interpersonal or individual expectation, thus one's sense of freedom becomes limited, and results in personal discomfort. Personal space intrusions may be expressed by two types of distances, physical and symbolic. Personal space between individuals may be expressed in physical terms; however, in symbolic distance, spacing is not required to create a feeling of closeness or distance. In this manner, body movements and soft breathing increase symbolic distance, while staring and noise from afar decrease the distance.

According to Leibman (1970), three types of behaviors can cause a violation of one's personal space. First, physical distance may be excessive or insufficient for a specific goal; secondly, inappropriate configuration or body orientation may cause the violation. Finally, violations can result from excessive or insufficient symbolic distance. Possible reactions to these intrusions may include a re-establishment of the personal space, or a redefinition of the space. The individual, on the other hand, may just endure the intrusion, or may leave the particular situation.

In Fry and Willis' invasion study (1971), subjects were more likely to initiate a conversation and a smile with 5 year old invaders, and make avoidance gestures to the 10 year old invaders. No observable reaction was seen involving the 8 year old invaders. Male subjects used coats and parcels as barriers when close to the 10 year old, and specifically leaned away from the 10 year old males. Becker and

Mayo (1971) observed experimenter invasion in a cafeteria, where seats were marked by a subject's books and clothing. Invasion was defined as sitting either adjacent, across, diagonally, or directly in the marked seat. Seats that were directly taken by the intruder were not defended by the subjects, whereas, seats were defended in the adjacent and across conditions. The marked seat, appeared to be only reserved with no value placed upon it. Thus, an individual's need for a comfortable distance from others was temporarily served.

Felipe and Sommer (1967) found flight reaction following an intrusion upon a subject's personal space. McDowell (1972) observed intruders receiving less eye contact, while a number of investigators (Becker & Mayo, 1971; Leibman, 1970; Sommer & Becker, 1969) have shown that subjects are reluctant to intrude into another's personal space. Barefoot et al. (1972) showed a positive relationship between an experimenter's physical distance from a water fountain, and the temporal activation of that water fountain by subjects. However, the unpleasantness of the experimenter's closeness did not deter the subject from stopping or drinking from the fountain. This suggests that as long as a reasonable motive exists, subjects will be more inclined to intrude into another's personal space.

It is reasonable to assume that a person's physical distance will gradually become larger as the degree of intimacy decreases (Little, 1965). Investigators (Leibman, 1970; Sommer, 1959) have found that subjects sat closer to females than males, and that females maintained greater distances with a male than a female (Dosey & Meisels, 1969; Pedersen and Heaston, 1972; Petri et al., 1974; Sommer, 1959). Moreover, females were shown to have a smaller personal space (Horowitz, 1965; Horowitz et al., 1964), and were more easily threatened (Dosey & Meisels, 1969). Consequently, females were reluctant to invade someone else's personal space (Hartnett et al., 1974).

Many factors, Petri et al. (1974, 1975) argue, must be taken into account when characterizing personal space. They found that the determination of personal space was a result of a stranger's sex, the direction of approach, the subject's sex and age.

Hartnett et al. (1970) found that females more than males permitted confederates to invade their personal space. Results additionally implied that males scoring high on the heterosexuality scale allowed females to approach closer than males scoring low on the heterosexuality scale. Generally, subjects allowed the confederates to approach closer than they would approach the confederates.

Bailey et al. (1972) examined personal space under implied threat conditions. The investigators found that the personal space of the female subjects was affected by anxiety, whereas heterosexuality affected the personal space of the male subjects. Results further showed that males maintained greater distances from the male confederate, while little difference in distances was found between the females and either of the confederates. This contradicted the Dosey and Meisels (1969) findings, which also showed anxiety affecting female personal space. However, female subjects had greater proximity with other females, while males did not differ in their approach distances. This difference can possibly be explained by the kinds of stress used to produce anxiety. The former study showed stress as a function of an encroachment into another's personal space; whereas, in the latter study, peer evaluation of sexual attractiveness caused the stress. This may indicate that males, more than females, are affected by an implied violent threat condition.

It has been assumed that sexual characteristics influence the personal space in children. Petri and Huggins (1975) demonstrated that females, at all grade levels, kept greater distances with male strangers than with female strangers. Moreover, female personal space shapes were initially circular with female strangers; however, the shape became elliptical by the eighth grade. Males kept female strangers further away initially; however, this trend had reversed by the eighth grade. In addition, the shape of the personal space changed from circular to elliptical by the twelfth grade. Elliptical personal space, for both sexes, was initially seen in the fourth grade, when approached by a male stranger.

Meisels and Guardo (1969), like Lerner (1973), found that males displayed smaller distances than females in negative-affect situations, and in neutral-affect situations with the opposite sex. Guardo (1969) contributed to this finding by showing females placing themselves closer to silhouettes labeled best friend, or "very much liked", and further away from threatening or fearful situations. In another developmental study (Pedersen, 1973), females had a larger personal space in the first grade. However, this difference was not enough to reach significance. By the third grade, females had a significantly smaller personal space, which continued until the fifth grade.

Fisher's (1967) findings showed that appropriate spatial arrangements, which are learned in childhood, persist into adulthood. Like Fisher (1967), Baxter (1970) reported the importance of spatial schemata in children. Baxter found ethnic differences between the spacings of young children. Also observed in children was the maintenance, through their personal space, of negative stereotypes towards endomorphs and ectomorphs, and postive stereotypes towards mesomorphs (Lerner, 1973). Mallenby (1974) found that children with hearing impairments maintained greater physical distances than normal children. However, the personal space of hearing impaired children decreased if the purpose of the study was known to them. As a rule, findings showed that personal space in children decreased as their age increased (Meisels & Guardo, 1969), and personal space shapes taking elliptical form, requiring more distance in the rear than frontal area (Petri & Huggins, 1975). Guardo (1969) and Meisels and Guardo (1969) observed a negative correlation between physical proximity and psychological closeness, which became established at 11 or 12 years of age. Guardo (1969) demonstrated this using the feltboard technique, by showing that the degree of liking increased as the distance separating the two silhouettes decreased. Additionally, Meisels and Guardo (1969) found physical distance in early grades the smallest with same-sex pairs, in positive and neutral-affect situations. This trend reversed however in later grades, and was seen markedly in males, while heterosexual closeness appeared in the sixth or seventh grade.

Researchers have not, to any great extent, correlated learning with personal space. However, in one particular study, Bailey et al. (1973) demonstrated that learning, via modeling, can manipulate the personal space of children. Subjects, according to their condition, observed a model and object-person approaching each other, stopping at either a close (2.5 feet) or far (14.5feet) distance. A control group did not observe a model. After the observation, subjects performed identical tasks with the same object-person. Results showed that the modeling condition influenced personal space. The "modeling close" condition subjects allowed greater proximity than subjects in both non-modeling and "modeling far" conditions. However, subjects in the far modeling condition maintained greater distances than subjects in

the non-modeling condition. Sex differences were virtually nonexistent in the far modeling condition. Indeed, sex differences were more apparent in the non-modeling condition than either of the modeling conditions. This suggests that modeling may attenuate, rather than augment, sexual characteristics. In a broader sense, females tended to stay further away from the object-person. This was acutely seen in the non-modeling condition, when compared with the close modeling condition. Another general trend in the Bailey et al. (1973) study was that subject's approach was closer to the object-person than the object-person's approach to the subject. This is contrary to other studies (Bailey et al., 1972; Hartnett et al., 1970), which found an opposite trend for the two movements.

Modeling is one of the fundamental ways in which new modes of behavior are acquired, and existing patterns get modified (Bandura, 1969). Bandura (1965) and Bandura and Walters (1963) have reported that virtually all learning experiences, such as emotional responses or fearful and avoidant behavior, can occur through observing another's behavior. Gottfried and Gottfried (1974), in supporting Lefkowitz, Blake and Mouton (1955), reported that viewing various types of models differentially effected an individual's behavior.

Studies have demonstrated the modeling effect on behaviors in stress situations (Vernon, 1973), assertive situations (Hersen, Eisler & Miller, 1973; Young, Rimm & Kennedy, 1973) and mentally retarded children (Baer, Peterson & Sherman, 1967; Litronwonik, 1972). It has been similarly demonstrated that preschool children imitated non-reinforced Russian words (Brigham & Sherman, 1968), and that schizophrenic children acquired and maintained through imitation nonreinforced Norwegian words (Lovaas, Berberich, Perloff & Shaeffer, 1966). Montgomery and Landers (1974) substantiated Bandura's social learning theory by demonstrating a close approximation between a model's performance and a subsequent subject's performance. They additionally showed that subjects, who viewed a risk-taking model, took more chances in their succeeding task than those subjects viewing either the conservative taking model or no model.

However, a major controversy concerning the modeling theories focuses upon the necessary and sufficient conditions for the acquisition of new responses on an observation basis. The associative and classical conditioning theorists (Humphrey, 1921; Allport, 1924; Holt, 1931) assumed that temporal contiguity between the modeling stimuli and the imitator's response was sufficient for the occurrence of imitation. This does not, however, account for the psychological mechanisms that may be operating at the time, or the ordinary modeling sequences that do not have the model repeating irrelevant responses of the learner. Reinforcement theory, as expounded by Miller and Dollard (1941), assumed that the observational learning was contingent upon reinforcement of the imitative behavior. Under naturalistic conditions however, behavior that is imitated usually happens in the absence of direct reinforcement.

The affective feedback theory of Mowrer (1960) highlights the role of reinforcement and imitation as a case of instrumental learning. Bandura (1965), as a contiguity-mediational theorist has suggested that modeled response acquisition, in cognitive and representational form, was no-trial learning, where the observer does not engage in any overt responding trials. The representational system is of imagery formation and verbalization. The imaginery formation is a sensory conditioning process, in which the modeling stimuli elicits responses that become sequentially associated by the subject. The second representational system which accounts for the

speed of acquiring modeled stimuli, involves verbal coding of observed events.

As previously noted, modeling can change various aspects of human behavior. This type of behavioral manipulation has been extended to the area of personal space (Bailey et al., 1973). Such an investigation is important in childhood years, where personal space become initially established. The purpose of the present study will be to explore the effectiveness of modeling upon the personal space of young children. Thirty-two male and female subjects, from four elementary school grades will observe the modeling stimulus. Another 32 male and female subjects, from the same grade levels will not observe the modeling stimulus. Looking comparatively at the two experimental conditions, statements may be made concerning the effectiveness of modeling. Specifically, five predictions can be made, on the basis of the personal space and modeling literature previously discussed. a) Subjects in a modeling condition will imitate, in their task, the model they observed. b) Sexual differences will be attenuated in the modeling condition. c) Males in the modeling condition will maintain smaller distances with the object-person than their counterparts in the non-modeling condition. d) Female subjects, in the modeling condition, will approach the neutral-affect male object-person closer than their counterparts in the non-modeling condition. 3) Grade level differences will be attenuated in the modeling condition.

METHOD

Subjects

Sixty-four elementary grade students from the second, third, fourth, and fifth grades of the Lida Lee Tall Center on the Towson State University campus will serve as subjects. The subject population will be composed of eight male and eight female students from each of the four elementary grades. Age range for all subjects will be seven to ten years old.

Measures

The subjects will be asked to approach another student, and stop where they prefer to. The preferred distance will an appropriate distance selected by the subject, and will be expressed through the proximity the subject displays to the object-person. The preferred distance will be behaviorally measured, using a tape measure, from the subject's toes to the object-person's toes. This distance separating the subject and object-person will be the physical distance tabulated as the measure of personal space.

Glances made by the subject towards the object-person will be quantified after the subject stops at a preferred distance, but before the behavioral measure of personal space. The subject's glances will be defined as any eye movement, on the part of the subject, towards the general area of the object-person's face. The duration of such glances will be cumulatively measured by the experimenter using a stopwatch. The experimenter will be positioned behind, and to the side of the object-person, at a distance of five feet. Although the experimenter's position will make the measurement of the subject's subjective, this information may be useful for future personal space research.

Attempts will be made to reduce visual cues, such as posters, desks, and windows, so the subject will not be distracted from the modeling stimulus. One

experimental room will be located in the school. Room size will approximate 30 feet by 30 feet; however, only a 15 feet x 30 feet area will be used. On the floor, twelve feet apart, will be two strips of tape. One strip of tape will designate the positioning for the object-person, while the other strip of tape will designate the positioning point for the model and subject. A third strip of tape will connect the two positioning points, and will show the line of approach for both the model and subject.

Three chairs will be five feet from the modeling stimulus, and perpendicular to the object-person's positioning point. The middle chair, which will be used by

See Figure I

the subject, will be directly aligned with this positioning point. Behind the chairs will be a mobile blackboard, which will be perpendicular to the modeling stimulus' line of approach, and which will indicate an imaginary point on the line of approach that is 18 inches from the object-person's positioning point. The model will use the end of the blackboard as a guide to determine where she should stop her movement. A crevice between two floor tiles will also indicate the correct stopping distance; however, this second marker will not be known to the model, but will assist the experimenter in determining the accuracy of the model's stopping distance. The mobile blackboard will not be aligned with the subject in any manner, nor will the subject be aware of the blackboard's purpose.

Before the first subject of each grade is brought into the experimental room, the model will practice her approach towards the object-person three times. After each approach, the experimenter will give a general verbal reinforcement by stating "very good." Before the practice sessions begin, the experimenter will give the following instructions: "Both of you will be helping me for awhile. You will walk over to the two tapes in front here, with (e. g., Johnny) (object-person) here, and (e. g., Linda) (model) there. Then _____(model) will walk towards _____(object-person), and stop where I want you to. To help_____(model) stop at that distance, I have here a blackboard for you to line up with. It is very important that you line up with the blackboard. During this time _____(object-person) will be standing with his toes on the edge of the tape. It is also very important that you do not talk or laugh while you help me., because other students will be brought into the room, and they will be sitting next to you. While the students are in the room, I will give instructions. You are to listen to the instructions because they will tell you when to do things. The instructions will ask_____(model) to stop where she wants to, but you will stop only at the place where I want you to. Sometimes _____(model) will not do anything except sit in her seat when some students come in. Are there any questions? Now let's practice what you will do." Each practice session will consist of the model and object-person sitting in their seats while the experimenter reads another set of instructions, which will be the same as those read to the non-modeling condition subjects. After the instructions are read, the model will practice her approach.

Design

One female and one male from each grade level will be selected as the model and object-person respectively. Selection of the confederates will be determined from their teacher's rank order lists. Each grade level teacher will be instructed to

rank order male students and female students separately, according to each student's participation in the daily activities that would include any or all of the students in the class, regardless of their sex. Using daily school activities, the teacher will be able to establish those students who are engaged the most in these interpersonal activities, and those students who are engaged the least in these activities. Such daily activities will include playing with other students, being picked or asked by other students to join in activities, eating lunch with other students, and verbally interacting, in a social manner, with other students. Students who are judged as being in the middle of this continuum by the experimenter will be selected as the confederates in this study. The ages of the confederates will remain within the age range of the subjects being tested (e. g., a second grade model and object-person for second grade subjects).

Subjects will be randomly assigned, except for sex and grade level, to either the modeling or non-modeling condition. Prior tc their task, modeling condition subjects will individually view the model approach the object-person. The modeling stimulus will not be observed in the non-modeling condition.

The study will have a three variable (modeling, sex of subject, and grade level) between subjects statistical design. Analysis of the results will be analysis

See Table 1

of variance.

Procedure

All models will be female and all object-persons will be male. Modeling condition subjects will be brought into the room, where the model object-person will already be seated in the end chair. The subject will be instructed to sit in the middle chair. After all the participants are seated, the experimenter will give the following set of instructions: "I would like to find out how close boys and girls want to be to each other. Listen very carefully while I tell you what I want you to do. First (e. g., Johnny) (object-person) and (e. g., Linda) (model) will move to the tape in front here. _____(object-person) will place his toes at the edge of the tape here, and _____(model) will place her toes at the edge of the tape there. When I say start, _____(model) will walk towards _____(object-person), and stop where she wants to. _____(model) will stand there until I tell her to sit down. After she finishes, _____(subject) will go and stand with _____(his/her) toes on the edge of the tape where _____ (model) first was. When I say start, _____(subject) will walk towards _____ (object-person) and stop where _____(subject) wants to. When _____(subject) stops, _____(he/she) will stand still until I tell _____(him/her) to sit down. Are there any questions?"

After the instructions, the model and object-person will position themselves at the two tapes. The model will be instructed to begin her approach, which she will stop at 18 inches from the object-person. The 18 inches separating the object-person and the model is the same distance that ends Hall's (1959) intimate zone. The model will stand still at this distance for a 15 second time period.

When this time period ends, the experimenter will say "very good", and instruct the model to sit down. This will end the modeling stimulus.

The subject will then proceed to the positioning point, where the subject will be instructed to approach the object-person. After stopping at a preferred distance, the subject will stand still for 15 seconds. During this time period, the duration of the glances made by the subject, towards the object-person, will be measured to the nearest second by the experimenter using a stopwatch. When the 15 seconds lapse, the experimenter will approach the subject and measure the preferred distance in centimeters. This will end the task for the modeling condition subjects. In the classroom, arrangements will be made to separate those modeling condition subjects, who will have already participated in the study, from those subjects who have not yet participated in the study.

Subjects in the non-modeling condition will not observe the model, and the set of instructions will differ slightly with those read in the modeling condition. The apparatus, model, object-person, and subject task will be identical to those in the modeling condition. Immediately after entering the room, the subject will be asked to take a seat where the model and object-person will already be seated. The experimenter will then give the following set of instructions: "I would like to find out how close boys and girls want to be to each other. Listen very carefully while I tell you what I want you to do. First _____(object-person) and _____(subject) will move to the tape in front here. _____(object-person) will place his toes at the edge of the tape here, and _____(subject) will place _____(his/her) toes at the edge of the tape there. When I say start, _____ (subject) will walk towards _____ (object-person), and stop where _____(he/she) wants to. _____(subject) will stand there until I tell _____(him/her) to sit down. Are there any questions?"

The model will not have any task to perform when the non-modeling subjects are in the room. The model will be seated, and will observe the subject's task. The measurements of the preferred distance and eye glances will be identical to those in the modeling condition. The classroom arrangements for the non-modeling condition subjects will be the same as those for the modeling condition subjects.

RESULTS AND DISCUSSION

The present study will analyze three variables and four interactions resulting from them. The three variables will be modeling, sex of subject, and grade level. The interactions will be three two way interactions of these variables, and one three-way interaction.

A significant modeling effect would illustrate personal space manipulation via a social learning tool, modeling. Modeling condition subjects should approach the object-person more closely than the non-modeling subjects, who should maintain greater distances with the object-person. However, other conclusions may be drawn from this result, such as the effectiveness of the model, the role of a neutral-affect person, and the close proximity between opposite-sex pairs of children, called heterosexual closeness. Studies (Guardo, 1969; Meisels & Guardo, 1969) have found greater physical distance between heterosexual pairs than same-sex pairs, as well as an inverse relationship between physical distance and the degree of intimacy and/or psychological closeness. From these two conclusions, it may be assumed that at most, a small degree of intimacy and/or psychological

closeness exists between heterosexual pairs. In the present experiment, modeling condition male subjects will acquire modeling cues, and will imitate the female model's performance. This will demonstrate the existence of intimacy and/or psychological closeness between the modeling condition male subjects and the neutral-affect female model. The model in the present experiment will have few characteristics which subjects could identify with or admire. Under these conditions, previous social learning experiments (Bandura, 1969, 1971; Bandura and Huston, 1961; Grusec & Mischel, 1966) have concluded that subject acquisition of the modeling cues would be hindered. However, modeling cues acquisition by the modeling condition subjects will not be hindered, as they will imitate the model's performance.

The present experiment may show that, contrary to previous findings (Guardo, 1969; Lerner, 1973; Little, 1965; Meisels & Guardo, 1969), subjects who viewed the modeling stimulus will approach close to the neutral-affect object-person. Heterosexual closeness will be denoted by a closer proximity between female subjects in the modeling condition and the male object-person, when compared to their counterparts in the non-modeling condition. This type of heterosexual closeness has been reported as occuring about the sixth or seventh grade (Meisels & Guardo, 1969).

An insignificant modeling effect will indicate that approach distances between the two experimental conditions do not differ. This may be a result of several factors. One such factor is the subject attending to the modeling stimulus. Visual cues will be minimally reduced; however, it may be speculated that this will not be adequate enough for the modeling stimulus to receive the undivided attention of the subject. Previous research (Bandura, 1969, 1971) suggests that modeling repetition expedites subject acquisition of the cues. Consequently, a modeling stimulus that occurs once may limit the subject's opportunity to acquire the modeling cues. The model's characteristics may also be a factor causing an insignificant modeling effect. The model's neutral-affect characteristic may indeed have a negative effect upon subject imitation of the model. This will reaffirm previous findings in both personal space (Guardo, 1969; Lerner, 1973; Meisels and Guardo, 1969) and social learning (Bandura, 1969, 1971; Bandura & Huston, 1961; Grusec & Mischel, 1966) areas concerning neutral-affect individuals. An effort in the present experiment will be made to facilitate subject acquisition through a mild reinforcement given to the confederates after the completion of the modeling stimulus; however, this verbal reinforcement may not be strong enough to facilitate subject acquisition of modeling cues in the modeling condition. This will reaffirm social learning findings (Baer & Sherman, 1964; Luchins and Luchins, 1966) concerning reinforcement as an important instrument in changing behavior.

The second main effect, sex of subject, may be significant. This will indicate that males and females have different approach distances with the same object-person. Other studies (Guardo, 1969; Lerner, 1973: Meisels & Guardo, 1969; Petri & Huggins, 1975) have also found that sexual characteristics influence how close one person will approach another. On the other hand, the sex of subject effect may be insignificant. In this case male and female subjects will be seen as having similar approach distances with the object-person, in contrast to earlier findings (Lerner, 1973; Pedersen, 1973) which showed a sexual differential.

A grade level significance may demonstrate that subjects react differently in their approach distance, according to their grade level, in the experimental conditions. This may be due to a greater dissimilarity between two or more grade levels,

rather than a difference between all grade levels. The grade level effect may turn out insignificant. Such insignificance would mean that regardless of the subjects'grade level, their approach distances are similar. This has been previously reported by Lerner, Vennine and Knapp (1975).

The two-way interaction between modeling and sex of subject may be significant also. This would indicate that the subject's approach distance will be affected by both the subject's viewing the modeling stimulus, and the subject's sex. A closer examination of the significant interaction may show that while males and females maintain different approach distances, their approach distances will also be affected by whether they viewed a modeling stimulus or not.

Within the modeling condition, female subject imitation of the model will denote heterosexual closeness, which has not been previously observed with this subject population. Although insignificant, females in the modeling condition will show greater proximity with the object-person than males, in the same condition. This in itself will be in contrast to the approach distance of the females in the non-modeling condition, as well as in findings by other researchers (Bailey et al., 1972; Dosey & Meisels, 1969, Guardo, 1969; Meisels & Guardo, 1969).

The interaction between modeling and the sex of subject may be insignificant. This would indicate that the two variables together do not affect the distance the subject will approach the object-person. However, a closer examination of the interaction may find that while subjects do not differ according to their sex, subjects in the modeling condition will exhibit greater proximity with the object-person than their counterparts in the non-modeling condition.

Another interaction will be between modeling and grade level. If significant, the interaction will show a simultaneous influence of the modeling stimulus and the children's grade level on the subject's approach distance. A significant interaction will show that the modeling stimulus affects the subjects' approach differentially as a function of their grade level.

If the interaction turns out insignificant, it will simply mean that modeling is ineffectual in altering personal space in children of different grade levels. While subjects may not respond differently according to their grade level, modeling condition subjects may show greater proximity with the object-person than subjects in the non-modeling condition.

The last two-way interaction will be between the variables sex of subject and grade level. Significance in this interaction will demonstrate that the approaching distance of the subject will be determined by the subject's sex and grade level together. Earlier studies (Guardo, 1969; Meisels & Guardo, 1969) have shown that females, more than males, will keep greater distances with a neutral-affect object-person, across grade levels, and a significant interaction in the present experiment would confirm this.

The sex of subject and grade level interaction may turn out to be insignificant. This will indicate the ineffectiveness of these two variables in influencing the proximity the subject displays to the object-person.

The last statistical interpretation to be made will be the three-way interaction, the combined effect of the modeling, sex of subject, and grade level variables. If significant, the three-way interaction will demonstrate that approach distances are influenced by the modeling stimulus, but depends also upon the subject's sex and grade level.

This three-way interaction may be insignificant. If this happens, it may be concluded that the subject's approach distance will not be affected by the three variables working together. This will not however, stipulate that modeling, sex of subject, or grade level are individually ineffective in altering personal space.

References

Alligeier, A. R. & Byrne, D. Attraction toward the opposite sex as a determinant of physical proximity. Journal of Social Psychology, 1973, 90, 213-219.

Allport, F. H. Social Psychology. Cambridge, Massachusetts: Riverside Press, 1924.

Argyle, M. & Dean, J. Eye contact, distance, and affiliation. Sociometry, 1965. 28, 289-304.

Baer, D. M., Peterson, R. F. & Sherman, J. A. The development of imitation by reinforcing behavioral similarity to a model. Journal of the Experimental Analysis of Behavior, 1967, 10, 405-416.

Bailey, K. G., Hartnett, J. J. & Gibson, F. W., Jr. Implied threat and the territorial factor in personal space. Psychological Reports, 1972, 30, 263-270.

Bailey, K. G., Hartnett, J. J. & Glover, H. H. Modeling and personal space behavior in children. Journal of Psychology, 1973, 85, 143-150.

Bandura, A. Vicarious processes: A case of no-trial learning. In L. Berkowitz (Ed.), Advances in Experimental Social Psychology. Vol. 2. New York: Academic Press, 1965.

Bandura, A. Principles of Behavior Modification. New York: Holt, Rinehart & Winston, 1969.

Bandura, A. Social Learning Theory. Morristown, New Jersey: General Learning Press, 1971.

Bandura, A. & Walters, R. H. Social Learning and Personality Development. New York: Holt, Rinehart & Winston, 1963.

Barash, D. P. Human ethology: Personal space reiterated. Environment and Behavior, 1973, 5, 67-72.

Barefoot, J. C., Hoople, H. & McClay, D. Avoidance of an act which would violate personal space. Psychonomic Science, 1972, 28, 205-206.

Baxter, J. C. Interpersonal spacing in natural settings. Sociometry, 1970, 33, 444-456.

Becker, F. D. & Mayo, C. Delineating personal distance and territoriality. Environment and Behavior, 1971, 3, 375-381.

Blood, R. O. & Livant, W. P. The use of space within the cabin group. Journal of Social Issues, 1957, 13, 47-53.

Blumenthal, R. & Meltzoff, J. Social schemas and perceptual accuracy in schizophrenia. British Journal of Social and Clinical Psychology, 1967, 6, 119-128.

Brigham, T. A. & Sherman, J. A. An experimental analysis of verbal imitation in preschool children. Journal of Applied Behavior Analysis, 1968, 1, 151-158.

Darling, F. A Herd of Red Deer. London: Oxford University Press, 1937.

Dosey, M.A. & Meisels, M. Personal space and self-protection. Journal of Personality and Social Psychology, 1969, 11, 93-97.

Duke, M.P. & Nowicki, S., Jr. A new measure and social-learning model for interpersonal distance. Journal of Experimental Reasearch in Personality, 1972, 6, 119-132.

Evans, G.W. & HOward, R.B. Personal space. Psychological Bulletin, 1973, 80, 334-344.

Exline, R.V. Explorations in the process of person perception: Visual interaction in realtion to competition, sex, and need for affiliation. Journal of Personality, 1963, 31, 1-20.

Exline, R.V., Gray, D. & Schuette, D. Visual behavior in a dyad as affected by interview content and sex of respondent. Journal of Personality and Social Psychology, 1965, 1, 201-209.

Felipe, N.J. & Sommer, R. Invasions of Personal space. Social Problems, 1967, 14, 206-214.

Fisher, R.L. Social schemas of normal and disturbed children. Journal of Educational Psychology, 1967, 58, 88-92.

Fry, A.M. & Willis, F.N. Invasion of personal space as a function of the age of the invader. Psychological Record, 1971, 21, 385-389.

Gerber, G.L. Psychological distance in the family as schematized by families of normal, disturbed, and learning-problem children. Journal of Consulting and Clinical Psychology, 1973, 40, 139-147.

Goldberg, G.N., Kiesler, C.A. & Collins, B.E. Visual behavior and face-to-face distance during interaction. Sociometry, 1969, 32, 43-53.

Goldfarb, W. & Mintz, J. The schizophrenic child's reaction to time and space. Archives of General Psychiatry, 1961, 5, 535-543.

Gottfried, A.W. & Gottfried, A.E. Influence of social power vs. status envy modeled behaviors on children 's preferences for models. Psychological Reports, 1974, 34, 1147-1150.

Guardo, C.J. Personal space in children. Child Development, 1969, 40, 143-151.

Hall, E.T. The Silent Language. New York: Doubleday, 1959.

Hall, E. T. The Hidden Dimension. Garden City, New York: Doubleday, 1966.

Hartnett, J. J., Bailey, K. G. & Gibson, F. W., Jr. Personal space as influenced by sex and type of movement. Journal of Psychology, 1970, 76, 139-144.

Hartnett, J. J., Bailey, K. G. & Hartley, C. S. Body height, position and sex as determinants of personal space. Journal of Psychology, 1974, 87, 129-136.

Hersen, M., Eisler, R. & Miller, P. M. Effects of practice, instructions and modeling on components of assertive behavior. Behaviour Research and Therapy, 1973, 11, 443-451.

Holt, E. B. Animal Drive and the Learning Process. Vol. 1. New York: Holt, 1931.

Horowitz, M. J. Human spatial behavior. American Journal of Psychotherapy, 1965, 19, 20-28.

Horowitz, M. J. Spatial behavior and psychopathology. Journal of Nervous and Mental Disease, 1968, 146, 24-35.

Horowitz, M. J., Duff, D. F. & Stratton, L. O. Body-buffer zone. Archives of General Psychiatry, 1964, 11, 651-656.

Howard, E. Territory in Bird Life. London: John Murray, 1920.

Humphrey, G. Imitation and the conditioned reflex. Pedagogical Seminary, 1921, 28, 1-21.

Katz, D. Animals and Men. New York: Longmans, Green, 1937.

King, M. G. Peck frequency and minimal approach distance in domestic fowl. Journal of Genetic Psychology, 1965, 106, 35-38.

Kinzel, A. F. Body-buffer zone in violent prisoners. American Journal of Psychiatry, 1970, 127, 59-64.

Kleck, R., Buck, P. L., Goller, W. L., London, R. S., Pfeiffer, J. R. & Vukcevic, D. P. Effects of stigmatizing conditions on the use of personal space. Psychological Reports, 1968, 23, 111-118.

Kuethe, J. L. Social schemas. Journal of Abnormal and Social Psychology, 1962, 64, 31-38.

Kuethe, J. L. Pervasive influence of social schemata. Journal of Abnormal and Social Psychology, 1964, 68, 248-254.

Kuethe, J. L. Prejudice and aggression: A study of specific social schemata. Perceptual and Motor Skills, 1964, 18, 107-115 (a)

Lefkowitz, M. M., Blake, R. R. & Mouton, J. S. Status factors in pedestrian violation of traffic signals. Journal of Abnormal and Social Psychology, 1955, 51, 704-706.

Leibman, M. The effects of sex and race norms on personal space. Environment and Behavior, 1970, 2, 206-246.

Lerner, R. M. The development of personal space schemata toward body building. Journal of Psychology, 1973, 84, 229-235.

Lerner, R. M. The development of personal space schemata toward body building. Journal of Psychology, 1973, 84, 229-235.

Lerner, R. M., Venning, J. & Knapp, J. R. Age and sex effects on personal space schemata toward body build in later childhood. Developmental Psychology, 1975, 11, 855-856.

Levinger, G. & Gunner, J. The interpersonal grid: 1. Felt and tape techniques for the measurement of social relationships. Psychonomic Science, 1967, 8, 173-174.

Lewin, K. A Dynamic Theory of Personality. New York: McGraw-Hill, 1935.

Litrownik, A. J. Observational learning in retarded and normal children as a function of delay between observation and opportunity to perform. Journal of Experimental Child Psychology, 1972, 48, 117-125.

Little, K. B. Personal space. Journal of Experimental Social Psychology, 1965, 1, 237-247.

Lott, D. F. & Sommer, R. Seating arrangements and status. Journal of Personality and Social Psychology, 1967, 7, 90-95.

Lovaas, O. I., Berberich, J. P., Perloff, B. F. & Schaeffer, B. Acquisition of imitative speech by schizophrenic children. Science, 1966, 151, 705-707.

Luchins, A. S. & Luchins, E. H. Learning a complex ritualized social role. The Psychological Record, 1966, 16, 177-187.

Mallenby, T. W. Personal space: Direct measurement techniques with hard-of-hearing children. Environment and Behavior, 1974, 6, 117-122.

McBride, G. & Foenander, F. Territorial behavior in flocks of domestic fowl. Nature, 1962, 194, 102.

McBride, G., James, J. W. & Shoffner, R. N. Social forces determining spacing and head orientation in a flock of domestic hens. Nature, 1963, 197, 1272-1273.

McDowell, K. V. Violations of personal space. Canadian Journal of Behavioural Science, 1972, 4, 210-217.

Mehrabian, A. Relationship of attitude to seated posture, orientation, and distance, Journal of Personality and Social Psychology, 1968, 10, 26-30.

Meisels, M. & Dosey, M. A. Personal space, anger-arousal, and psychological distance. Journal of Personality, 1971, 39, 333-343.

Meisels, M. & Guardo, C. J. Development of personal space schemata. Child Development, 1969, 40, 1167-1178.

Miller, N. E. & Dollard, J. Social Learning and Imitation. New Haven, Connecticut: Yale University Press, 1941.

Montgomery, G. T. & Landers, W. F. Transmission of risk-taking through modeling at two age levels. Psychological Reports, 1974, 34, 1187-1196.

Mowrer, O. H. Learning Theory and the Symbolic Processes. New York: Wiley, 1960.

Newman, R. C., II & Pollack, D. Proxemics in deviant adolescents. Journal of Consulting and Clinical Psychology, 1973, 40, 6-8.

Patterson, M. Spatial factors in social interactions. Human Relations, 1968, 21, 351-361.

Patterson, M. & Sechrest, L. Interpersonal distance and impression formation. Journal of Personality, 1970, 38, 161-166.

Pedersen, D. M. Development trends in personal space. Journal of Psychology, 1973, 83, 3-9.

Pedersen, D. M. Personality and demographic correlates of simulated personal space. Journal of Psychology, 1973, 85, 101-108. (a)

Pedersen, D. M. & Heaston, A. B. The effects of sex of subject, sex of approaching person, and angle of approach upon personal space. Journal of Psychology, 1972, 82, 277-286.

Petri, H. L. & Huggins, R. G. Some developmental characteristics of personal space. Paper presented at the 46th annual meeting of the Eastern Psychological Association, New York, 1975.

Petri, H. L., Huggins, R. G., Mills, C. J. & Barry, L. S. Variables influencing the shape of personal space. Paper presented at the annual meeting of the American Psychological Association, New Orleans, 1974.

Sanders, J. L. Relationship of personal space to body image boundary definiteness. Paper presented at the annual meeting of American Psychological Association, Chicago, August, 1975.

Sommer, R. Studies in personal space. Sociometry, 1959, 22, 247-260.

Sommer, R. Personal Space: The Behavioral Basis of Design. Englewood Cliffs, New Jersey: Prentice-Hall, 1969.

Sommer, R. & Becker, F. D. Territorial defense and the good neighbor. Journal of Personality and Social Psychology, 1969, 11, 85-92.

Stern, W. General Psychology, translated by H. D. Spoerl, New York: Macmillan, 1938.

Stratton, L. O., Tekippe, D. J. & Flick, G. L. Personal space and self-concept. Sociometry, 1973, 36, 424-429.

Tolor, A. Psychological distance in disturbed and normal children. Psychological Reports, 1968, 23, 695-701.

Tolor, A. Psychological distance in disturbed and normal adults. Journal of Clinical Psychology, 1970, 26, 160-162.

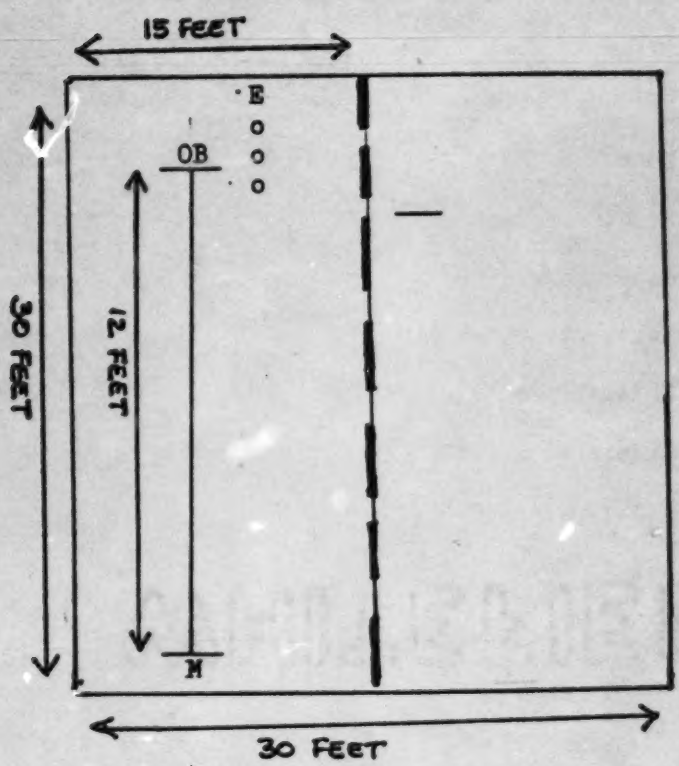
Tolor, A. & Donnon, M. S. Psychological distance as a function of length of hospitalization. Psychological Reports, 1969, 25, 851-855.

Vernon, D. T. Use of modeling to modify children's responses to a natural potentially stressful situation. Journal of Applied Psychology, 1973, 58, 351-356.

Weinstein, L. Social schemata of emotionally disturbed boys. Journal of Abnormal and Social Psychology, 1965, 70, 457-461.

Young, E., Rimm, D. C. & Kennedy, T. D. An experimental investigation of modeling and verbal reinforcement in the modification of assertive behavior. Behaviour Research and Therapy, 1973, 11, 317-319.

Figure 1



E = Experimenter's position

OB = Object-person's positioning point

M = Model and Subject's positioning point

—— = Blackboard's position

o = Chairs to be used by the participants

Table I

Analysis of Variance Summary Table

Source	d.f.
Total	63
Between Cells	15
Modeling (A)	1
Sex of Subject (B)	1
Grade Level (C)	3
Interaction (AxB)	1
Interaction (AxC)	3
Interaction (BxC)	3
Interaction (AxBxC)	3
Within Cells	48

(Continued from inside of front cover)

environment uncontaminated by the very necessary restrictions imposed on public schools. The B. F. Skinners and Jean Piagets have opened all kinds of new hypotheses that researchers are begging to investigate, but all too often cannot gain access to a controlled environment in which to conduct a study.

In order to disseminate research and relevant educational development, the Lida Lee Tall Center publishes, "Probe," an acronym for Probing Resources of Better Education. This bi-yearly publication is sent to all laboratory schools in the United States, to all colleges and universities in Maryland, to research and education departments in the various Maryland counties, to libraries in surrounding counties, and to a multitude of educators, administrators, etc., who have made written requests. In addition, all completed research studies are available at the Lida Lee Tall Center for in-depth study by researchers.

Relating directly to our children, the parents, faculty, and administration of the Learning Resources Center have developed an educational philosophy, a set of goals worthy of note. They are as follows:

1. To respect each child, and help him develop a sense of dignity, sensitivity and self worth.
2. To help each child develop a love of learning.
3. To encourage attitudes and values consistent with democracy.
4. To encourage a questioning attitude coupled with self-direction and responsibility.
5. To help each child realize that he/she is an effector, rather than a victim of change.
6. To develop an awareness and appreciation of environmental interaction.
7. To guide each child toward the creation of his own code and purpose for living.
8. To be patient with each child, and give him our love and understanding.
9. To develop an appreciation for the benefits of a multi-ethnic culture.
10. To provide each child with an educational program utilizing the latest methods and techniques, while meeting individual and group needs.

It is clear to all concerned with educational excellence that the benefits of a Learning Resources Center are great. A society valuing diversity must place a high priority on the continued service role of a center devoted to educational inquiry. The Lida Lee Tall Learning Resources Center will continue to provide the kinds of service suited to the changing needs of individuals and society. Our responsibility is to maintain our position on the leading edge of educational inquiry and innovation.

We would welcome inquiries and comments from educators interested in expanding the boundaries of knowledge. Questions or requests to visit the Center should be directed to Bernard G. Taylor, Administrative Director, Lida Lee Tall Learning Resources Center, Towson State University, Baltimore, Maryland 21204 - Area Code 301-321-2351.

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